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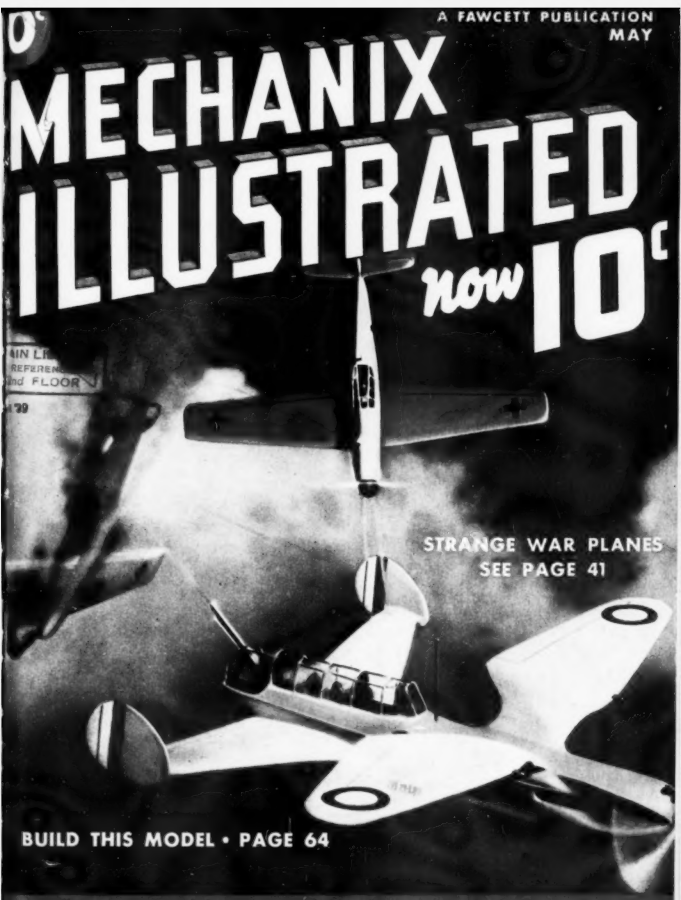

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Maryland. While studying your courses I advanced rapidly and at present I am Industrial Engineer in the Baltimore Industrial Department of the Chemical Company of America (in charge of Methods and Layout) and assistant to Mr. H. L. Shipley, Baltimore, Md.

Missouri. Shortly after I enrolled with the I. C. S., I advanced to Layerout Foreman, then Chief Layerout, and at present I am Production Control man. Lawrence E. Foster, St. Louis, Mo.

California. My I. C. S. training, plus experience, qualified me to plan larger building projects. The interior design of some of the larger rooms of the remodeled S. S. City of Honolulu was one of these. J. Raymond Wyatt, Los Angeles, Calif.

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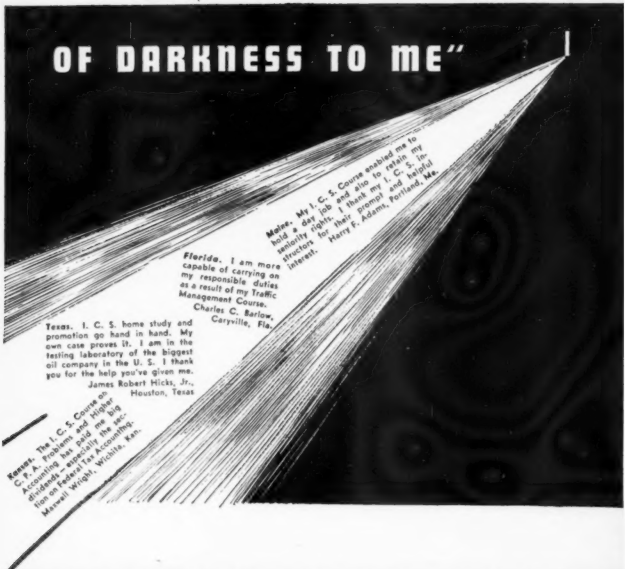

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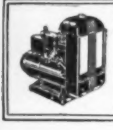

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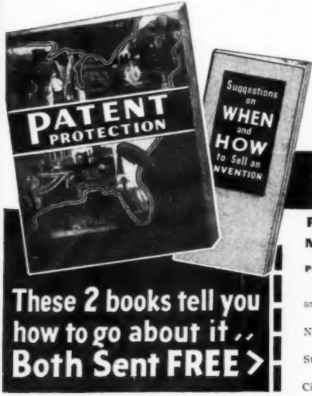

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WHICH OF THESE MEN IS YOU?

Is This You? OR *Is This You?*

1. "My name is Stark. I'm never late mornings. I get back promptly from lunch—often work overtime cheerfully. I carefully do every single job they give me and in six years I have done each job so many times that I'm letter-perfect! Only one little raise so far, but some day I ought to get a good one. I'm probably the steadiest, most loyal employee in the whole office. One of these days the boss will realize that I'm the best man who ever worked on this job. *Then* I'll show these other fellows a thing or two!"

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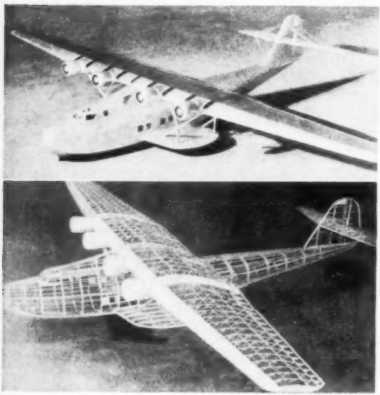
Chips from the Editor's Workbench

Send in photos of your completed workshop projects. Each month Mechanix Illustrated awards a first prize of $5 for the best photo and letter received by this department and prizes of $3 each for all other photos and letters used.



This 8-foot model of the famous China Clipper flying boat was constructed by Robert D. Hawkins, of Ashley, Ind. The photo of the uncovered structure provides some idea of the craftsmanship involved. About 1200 pieces of balsa were used in assembling the intricate wing structure.

A CAREFUL study of the photographs above will, I am sure, convince you that this month's first prize Workbench award of $5 was well earned by Robert D. Hawkins, of Ashley, Ind., who built the China Clipper model airplane shown in the photos. The wing alone consists of about 1,200 pieces of balsa wood and the built-up hull clearly indicates that an equal amount of skill and patience was required to construct it. The wingspan of the model is eight feet. Without exaggerating, Bob, I personally rate the model as one of the best examples of model airplane craftsmanship I have ever seen.

In addition to winning the cash award, Bob is also entitled to a rating as one of MI's most prolific craftsman-readers inasmuch as he sent along some photos showing several other projects he completed, such as a trailer, two gas model airplanes, and a camera tripod. I'm sorry I couldn't publish photos of all your projects, Bob, but I certainly was glad to look them over.

With the approach of spring, it is natural that the thousands of MI boating fans throughout the country are getting active again and several swell photographs of home-built boats have already been received. Winning an award of $3, J. H. Clay, of Atlanta, Ga., sent in the photo shown below. The boat is a "*SCRAM*," which he built from plans that appeared in the MI book—How To Build 20 Boats. Power is provided by a converted V-8 automobile engine of 85 horsepower and Clay claims the craft can speed along at 40 m.p.h. Certainly is a professional looking job, Clay. Your craftsmanship is excellent.

* * *

So many requests for information concerning home-built airplanes have been received by the Workbench that I feel it is timely to once again tell our air-minded readers that we no longer publish *new* plans for home-built aircraft, although copies of our 1931-32 Flying Manuals containing plans for planes powered by converted auto engines are still available at 50c per copy. If you are interested in home-built aircraft, I suggest you write to the Private Flyers Association of Eugene, Oregon.

* * *

A "walk away" for a $3 prize was the photo sent in by Fremont Wood, of Ashtabula, Ohio,

[*Continued on page* 12]

Rivaling a professionally constructed boat in appearance, this SCRAM was built from MI plans by J. H. Clay. A converted V-8 automobile engine of 85-horsepower enables it to travel at speeds up to 40 m.p.h.

INVENTORS

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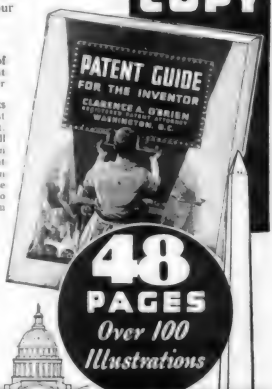

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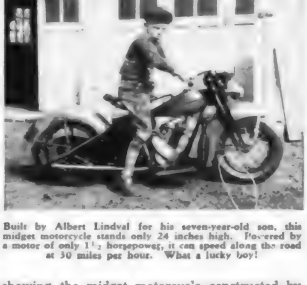
Editor's Workbench Chips

[*Continued from page* 10]



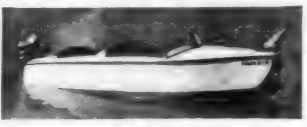
Built by Albert Lindval for his seven-year-old son, this midget motorcycle stands only 24 inches high. Powered by a motor of only 1½ horsepower, it can speed along the road at 30 miles per hour. What a lucky boy!

showing the midget motorcycle constructed by his friend Albert Lindval. The motorcycle stands 24 inches high, weighs 125 pounds and all parts are hand-made. Powered by a 1½-horsepower motor, it attains a speed of 30 m.p.h., and travels 125 miles on a single gallon of gasoline. I'll bet that Mr. Lindval's 7-year-old son, who is shown riding the motorcycle, is the most envied boy in the neighborhood, Fremont. Am I right?

• • •

Another winner of a $3 award is Wayne Buckley, of Hickman, Ky., who sent in a photo of the boat he constructed from the "*BUZZER*" plans that appeared in MI's book—How To Build 20 Boats. Powered by a 32 horsepower outboard motor equipped with an electric starter, the *Pamalu*, as Wayne named his boat, carries five persons comfortably and steps along at a speed of about 15 m.p.h. despite the heavy load. As you can see from the photo, the outboard engine is hooked up to an automobile type steering wheel, adding to the craft's appearance and enabling it to be piloted from the front seat. Nice work, Wayne, I wish I was on hand to snitch a ride.

[*Continued on page* 14]



Boating enthusiasts will admire the trim lines of this outboard runabout, which was built by Wayne Buckley. Powered by a 32-horsepower outboard engine, it carries 5 passengers at a speed of 15 miles per hour.

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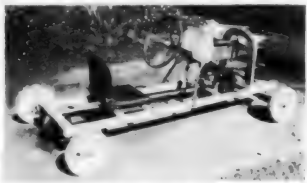
Editor's Workbench Chips

[Continued from page 12]



Robert Smith sent in this photo of the midget racer he constructed. Cowling was removed to show the arrangement of the engine and the leather belt drive hooked to the rear axle.

An award of $3 was sent to Robert Smith, of Binghampton, N. Y., for the photo he sent in showing the midget racer he constructed. He thoughtfully removed the body cowling before taking the photo so that MI readers could see how the engine is hooked up to the rear wheels by means of a leather belt which is fitted with a tightener lever that serves as a clutch. Bob claims a speed of 30 m.p.h. and mileage of 70 miles per gallon of gasoline. Nice work!

•••

Using an old washing machine motor, old bed rails and odds and ends from a scrap pile, J. R. Shawn, of McAllen, Texas, constructed a powered scooter, which is shown below. It's a swell job, Shawn, and I'm awarding you a $3 prize. (By the way—who is the charming young lady demonstrating the scooter? Maybe you should have built a two-seater).

[Continued on page 16]

An old washing machine engine, bed rails and odds and ends from a scrap heap enabled J. R. Shawn to build this excellent powered scooter, shown being demonstrated by a charming young lady. (How about a two-seater, Shawn?)

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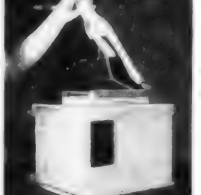
Editor's Workbench Chips

[Continued from page 14]

A $3 prize was awarded to Fay H. West, of Baltimore, Md., for the photo of his home-built photo printer. He used plans which appeared in the October, 1938 issue of MI and materials cost him about $3.85. Like many other photo fans, Fay says he thinks MI has the best photography department printed by any magazine. Thanks for the kind words, Fay.

• • •

Speaking of photography, be sure you get a copy of MI's latest book GOOD PHOTOGRAPHY NO. 2, which is now on sale at your local newsstand or can be purchased from our Greenwich, Conn., office for 50c per copy. You really cannot afford to miss this book, for its 144 pages are crammed full of the latest ideas in the photographic field—articles on how to make better pictures, darkroom processing, how-to-build subjects, kinks, etc. In addition you will find complete information about the big photo contest in which $500 in cash prizes will be awarded. Get your copy today!



Fay H. West built this photo printer from MI plans at a cost of only $3.85. He enthusiastically reports that it provides excellent results.

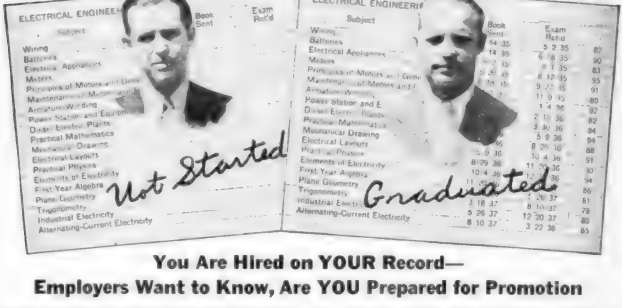
• • •

Another boating fan who won a $3 prize is J. M. Whittle, of Birmingham, Ala., who sent in the "action" photo shown below. Another "SCRAM," the boat was built by Whittle and R. O. Binford, a friend. Powered by a converted auto engine, the craft splits the waves at speeds up to 30 m.p.h., which is plenty fast on the water. Good work, fellows.

[Continued on page 18]

Shown ripping over the waves at a speed of about 30 m.p.h., this SCRAM boat was built by J. M. Whittle and R. O. Binford. A converted auto engine provides power.

On His Record—
Which Man Would YOU Hire?



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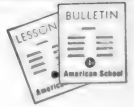

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Editor's Workbench Chips

[Continued from previous page]

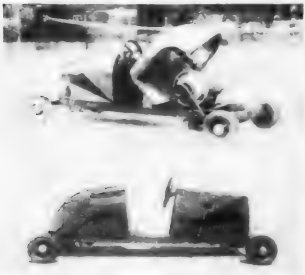
Have you something to "swap" for this airplane? Al Brazil, who constructed it, is willing to exchange it for "what have you." The home-built craft is powered by a Henderson four-cylinder air-cooled engine.

plane. Powered by a converted Henderson engine, the plane is of the parasol type and flies well, although—hold your breath, reader—he is willing to trade the plane for "what have you." I'm sending you a $3 prize, Al, and I know you are going to get a lot of mail from the boys. Al's street address is 314 Sandercock St. Enclose return postage when writing to him.

* * *

A well earned $3 award was sent to Bernard Etra, of New York, N. Y., for a photo of his home-built midget racer. The car is powered by a washing machine engine and drives along at 18 m.p.h. An outstanding feature is a sliding motor base, which eliminates clutch slip by preventing the drive belt from slipping. The brake was taken from an old motorcycle. The entire

[Continued on page 20]



Featuring a sliding motor base, which eliminates clutch slip by preventing the drive belt from slipping, this midget car was built by Bernard Etra. Note the hinged engine hood.

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Editor's Workbench Chips

[*Continued from page 19*]

body is made of hickory reinforced with iron, making a sturdy car. Well done, Bernard.

• • •

A photograph of his home-built drill press won a $3 prize for Ed J. Pool, of Eagle Grove, Iowa. The base is a fly-wheel from an old Dodge auto and the frame is a drive-shaft tube from a Model T Ford with a couple of ¾-inch pipe tees welded to it. The only machine work done was to cut the keyway and the threads for the chuck. Very clever, Ed. and well worthy of a prize.

Using parts salvaged from old automobiles, Ed J. Pool built this practical and sturdy drill press.

• • •

Springtime is also model airplane time. A photo of the "gas" model airplane he built won a $3 prize for John Vaneza, of Binghampton, N. Y. The model has a wing-span of five feet and is powered by a miniature gasoline engine of ⅕ horsepower. Complete, ready to fly, the model weighs two pounds, five ounces. Happy landings, John.

[*Continued on next page*]

John Vaneza proudly poses with the "gas" model airplane he constructed. Powered by a miniature gasoline engine of about one-fifth horsepower, the model has a wingspan of five feet. Total weight is two pounds, five ounces.

Editor's Workbench Chips

[Continued from previous page]

Upper photo-Close-up of the outboard runabout constructed by A. D. Montgomery. Powered by a 10-horsepower outboard engine, the craft can go 38 m.p.h. The lower photo shows the craft "doing her stuff." Overall length is 9 feet, 8 inches. Hull features oak frames, cypress planks.

A. D. Montgomery, of Corsicana, Texas, nicked the MI bank roll for a $3 prize by sending in a couple of photos of his home-built outboard runabout. The craft is only 9 feet, 8 inches long and is constructed of oak frames with a cypress covering. Powered by a 10 horsepower outboard engine, the boat can shit a speed of 38 m.p.h., according to Montgomery. You turned out a good looking job, A. D. Good luck!

• • •

A $3 prize was awarded to Kenneth D. Hay, of Appleton, Wis., who sent in the photo below, showing his 6-foot "gas" model airplane. Powered by a G. H. Q. motor, the plane has a simple single-frame fuselage and a three-bladed propellor. If enough readers write to the Workbench, I may try and induce Ken to prepare plans of the model and present them in MI. How about it, fellows?

[Continued on page 22]

Featuring a simple single framework fuselage and a three-bladed propeller, this "gas" model plane was built by Kenneth D. Hay. Powered by a GHQ motor, the model has a wingspan of six feet.

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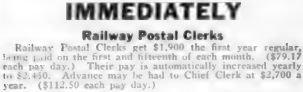

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Editor's Workbench Chips

[Continued from page 21]

Harley P. Weyand built this midget car for his son (another lucky fellow). The lower photo clearly shows how the washing machine motor is mounted at the rear with direct belt drive to axle. Top speed is about 18 m.p.h.

A photo of the trim midget car he built for his son earned a $3 award for Harley P. Weyand, of Cuyahoga Falls, Ohio. The car has a wheel-base of 64 inches and is powered by a washing machine engine of 1/2 horsepower. Equipped with 16-inch rear wheels and a direct drive to the axle, the car rolls along at 18 m.p.h. Accept my compliments for a job well done, Harley.

***

Model boat enthusiasts will be interested in the photo sent in by Oswald Larsen, of North Chicago, which shows the SUNBEAM speedboat he constructed from MI plans. He claims the model attains a speed of 15 m.p.h., which is very good considering the design of the boat and the small engine used. Okay, Oswald, I'm mailing you MI's check for $3.

***

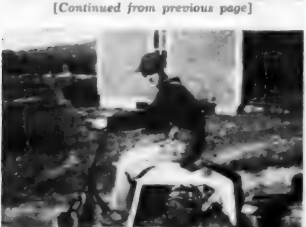
There doesn't seem to be any let up in interest in powered scooters, for every mail brings photos

[Continued on next page]

Oswald Larsen constructed this SUNBEAM model speedboat from plans that appeared in MI several years ago. He also built the miniature gasoline engine shown on stand in photo.

Editor's Workbench Chips

[Continued from previous page]

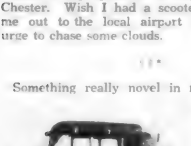


Chester Kunsman built this powered scooter at a total cost of only $30, including the washing machine motor used to provide power. Lower photo shows the details of motor mounting.

of several of them. Latest to arrive, the photo above was sent in by Chester Kunsman, of Burnside, Pa., who was awarded a $3 prize. He built the scooter at a total cost of $30, including the washing machine engine used for power, and reports a top speed of 20 m.p.h. Good work, Chester. Wish I had a scooter like it to take me out to the local airport when I feel the urge to chase some clouds.

* * *

Something really novel in model projects is shown in the photo sent in by John Carey, of Warm Springs, Montana, who was awarded a $3 prize. He built a model of an old Wells-Fargo stage coach of the type that had much to do with the early history of the west. The coach stands six inches high and is six inches long from axle to axle. Very novel, John, and a good example of first class model craftsmanship.



A really novel project is this six-inch model of a Wells-Fargo stage coach, which was built by John Carey.

* * *

A photograph of what is one of the most unusual airplane models ever brought to my attention

[Continued on page 24]

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Editor's Workbench Chips

[*Continued from page 23*]

Unusual in appearance and performance, the "gas" model airplane shown here has rotating wings. Constructed by H. T. Nelson, it flies well, as proved by upper photograph.

won a $3 prize for H. T. Nelson, of Dallas, Texas. As you can see from a study of the photograph the model is a type of rotating wing aircraft, the rotors always rotating freely in the same direction and independently of the motor. He claims the model is stall-proof, inasmuch as when the craft approaches the stalling point the rotors begin to slow up and the front end automatically begins to settle. This downward motion keeps the rotors turning and the model quickly approaches a horizontal position again. The wingspan is seven feet and a miniature gasoline engine of 1/5-horsepower provides the necessary power. As a flyer, I want to congratulate you for developing such a novel type of aircraft, Nelson.

•••

If you submit a photo of your project to the Workbench and it does not appear within a month or two after you send it in, do not jump to the conclusion that the photo has failed to score a prize. After all the Workbench space is limited and only a few of the hundreds of photos sent in can be used in any single issue. The photo you submitted may have impressed the judges, thus being set aside for possible future use unless a better photo of a similar project is received in the meantime. All the photos on hand are rejudged each month, assuring you of a better chance to win a Workbench prize. Don't be afraid to submit several photos of different projects at one time for you never can tell which one will earn the judges' "okay."

•••

So long until next month, fellows.—*The Editor.*

Cheap Pig Iron Produced From Poor Grade Ores

A British iron maker has been successfully producing cheap pig iron suitable for producing steel from relatively poor ores for two years now by a new and basically different treatment of the ore in the blast furnace, Prof. Richard S. McCaffery of the University of Wisconsin recently told the American Iron and Steel Institute.

Forced to make use of British ores low in iron and high in undesirable alumina by the great demand for iron and steel brought about by Europe's armament race the British firm has successfully applied an American suggestion. The process, Prof. McCaffery indicated, holds great promise of industrial use in this country and elsewhere where ironmakers are forced to turn to similar inferior ores.

Technicians handling the treatment of the low grade ore used disregard its varying and undesirable sulphur content during the blast furnace operation itself, an "omission" never before made in commercial production of pig iron, the raw material from which steel is made. Instead they use a combination of chemicals to remove the sulphur in a separate step.

Forgetting about the sulphur content during the blast furnace treatment, technicians operating the furnace are able to go ahead and produce the maximum amount of pig iron at minimum expense in the form of coke consumed and wasteful slag produced. This procedure is necessitated by the poor quality of the ore. If the usual method had been followed, it was indicated, production at a cost comparable to that of iron from higher grade ores would have been impossible.

The sulphur is removed by soda ash and fluorspar in a hot ladle into which the molten pig iron is poured. Many other technical advantages follow from the new procedure, Prof. McCaffery pointed out. The British plant is at Corby, Northamptonshire, very close to the ore supply.

Invents Spray Method For Coating Glass With Metal

New and improved forms of the highly decorative metal-coated glassware are now possible as a result of a spraying process developed and described by Andrew H. Stewart, of Shields, Pa.

The new spray method applies a thin layer of gleaming metal to the glass while it is still hot after coming from the shaping process.

Opacity can be guaranteed if necessary by painting on a thin layer of lacquer or paint the same color as the metal, Mr. Stewart declares. Spraying on an extremely heavy layer of metal is undesirable because of the weight it adds to the glassware.

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Not an expensive alloy steel, but a specially treated ordinary grade, "austemperized steel" can do things hitherto only possible for alloys and can do some things that special high-test materials cannot do, according to Edmund S. Davenport, U. S. Steel Corporation physical metallurgist.

Tougher and more durable shovels, garden tools, chisels, dies, springs and other tools requiring a combination of great hardness and flexibility will result from the process, now being reduced to a practical production stage, he recently asserted.

A new heat-treating process, in which the oil or water bath used for "quenching" red-hot steel is replaced by a bath of molten lead, salt or other material that does not combine chemically with steel, is the feature of the new material's production.

"This method of getting 'alloy steel properties' in certain grades of carbon steel, heretofore possible only by means of the more costly alloy steels, may bring to the general public savings of many millions of dollars in small tools and springs and a wide range of small steel products," Mr. Davenport said.

Quenching the red-hot steel in a high-temperature bath of molten lead or salt results in slower crystallization, thus avoiding the hard, brittle "martensitic condition," he explained.

Use of the process is as yet limited to relatively thin sections. The thickest steel that can be treated by the new process, the metallurgist concluded, appears to be between one-quarter and three-eighths of an inch thick.

Plane Has Retractable Wing

Residents of Helena, Montana, who have been watching the same airplane with two apparent wing sizes haven't been seeing things—it's the Con Ellingston Special, with a partially retractable wing to increase performance. The novel craft is now under test.

The new plane, it is reported, has a top speed of 110 miles an hour with landing gear and wings fully extended for take-off and landing purposes. Once in the air, the landing gear is taken up completely and the wing reduced in size so as to cut down drag and increase speed. (A plane requires less lift, therefore less wing area, when in flight than it does when taking off or landing.) Top speed when the wing area is reduced and the landing gear is up is said to be 165 miles an hour.

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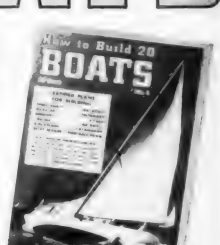

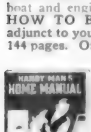

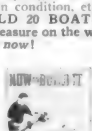

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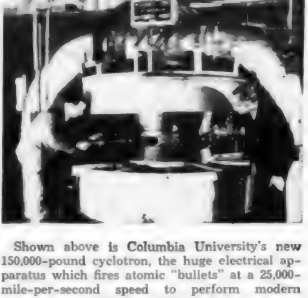
Columbia Gets Cyclotron



Shown above is Columbia University's new 150,000-pound cyclotron, the huge electrical apparatus which fires atomic "bullets" at a 25,000-mile-per-second speed to perform modern alchemy by changing one chemical element into another. Detailed study of nuclear forces, which are the ultimate forces that hold the materials of the universe together, will be one of the first tasks undertaken by Columbia physicists with the cyclotron.

The iron yoke around the apparatus weighs 65 tons and with the two huge tapered cores in the center of the photograph forms a giant electromagnet. The vacuum chamber where the "bullets" are accelerated by successive kicks up to energies of 10,000,000 volts is located between the cores. The sign above the magnet warns the unwary to keep watches away, as the magnetic field is powerful enough to damage a watch permanently.

Polarizing Disks Aid Making Of Underwater Movies

Polarizing disks, newest tool of photographers, are solving some of the problems encountered in making submarine motion pictures, the Society of Motion Picture Engineers learned recently.

Water does not absorb the various colors that make up white light so that underwater photography is extremely complex. Not only is natural color photography difficult but even black and white pictures are obscured by water "haze," by the decreased light and by uneven color absorption.

Moreover water, it is found, has the ability to polarize rays of light which pierce it. This polarized light has been troublesome in the past but the new polarizing disks—used successfully to eliminate glare in ordinary photography—are now found equally adaptable for submarine shots.

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Aeronautical Engineers Plan Streamlined Helicopter

A helicopter whose top speed will be 160 miles an hour, markedly in excess of hitherto existing types, is planned by a group of Philadelphia aeronautical engineers.

Featuring a completely streamlined fuselage and rotor supports for the first time in recent rotary wing aircraft history, the craft will be modeled after the twin-rotored Focke helicopter with which Hanna Reitsch, noted German woman pilot, has been astounding European aeronautical engineers.

Funds for the construction job are expected to come from the Dorsey bill for aid in the development of rotary-wing aircraft, when and if the appropriation under the bill is actually made. Congress is expected to make the appropriation in the near future.

Builders of the craft will be the Pennsylvania Aircraft Syndicate, with the construction program under E. Burke Wilford and Elliot Daland.

The ship will feature the mechanically-feathered rotor developed by the syndicate for the Gyroplanes it has built during the past few years for the U. S. Navy. The mechanically-feathered rotor differs from the autogiro rotor in that the angle of attack of the whirling blades is changed as they rotate by cams. The autogiro's blades' angle of attack is changed by the fact that the blades are hinged and swing up and down freely.

The angle of attack of the blades has to be smaller when the blade is moving forward than when it is moving back toward the tail of the plane in order for the rotor to operate with the greatest efficiency.

This plane, to be equipped with a motor of more than 250 horsepower, will, it is believed, be one of the first rotable wing aircraft fitted with a relatively large engine. The engine will be enclosed in the fuselage while the two rotors will be mounted at the end of streamlined "wings" that project out and up from the fuselage.

Miss Reitsch and the Focke helicopter won wide attention through her feat of taking off from a standing start and flying the plane inside a Berlin armory.

Development of this "cleaned up" American version of the Focke craft will be one of a number of promising developments in rotary wing aircraft that the Dorsey bill is expected to aid. Such ships have advantages that include negligible take-off and landing runs as well as improved control at very low speeds, below stalling speeds for regular airplanes.

One movie cartoon producing studio uses a recording spectrophotometer to make sure the colors of faces and clothing of the characters remain the same throughout a picture.

Urges Use Of Diesel Engines For Military Purposes

Pointing out that American manufacturers are now able, for the first time, to supply diesel engines of any desired type or size in American designs, Lt. Col. Walter C. Sanders, of the U. S. Army Specialist Reserve, makes a plea here for adoption of the diesel engine for military transportation purposes and for other uses in connection with national defense.

The diesel engine, noted for its efficient use of fuel oil, is safe from the fire hazard, a major consideration in wartime, Colonel Sanders declares. In addition, the fact that it does not require an electrical ignition system makes use of radio for vital military communications purposes far simpler.

Absence of the fire hazard is of great importance, he points out, particularly in connection with storage of the enormous quantities of fuel a modern army requires. In this day of long-range bombers, "a single direct hit" on a gasoline dump "could send thousands of gallons of gasoline up in flames with terrific incidental destruction. Furthermore, a carelessly discarded cigaret or an accidental spark easily could cause a disastrous explosion at any time."

Diesel engines burn a heavy fuel oil instead of gasoline. The fuel they require is extremely difficult to ignite, no case of accidental ignition and explosion of diesel fuel being on record. The fuel is fired in the engine by compression instead of by an electric spark.

Not only is the fuel it uses cheaper than gasoline, Colonel Sanders continues, but only half a pound of fuel is burned by a diesel engine in doing the same work for which a gasoline engine requires a pound of gas. When dealing with the enormous quantities of fuel required in wartime military transport, this becomes of vital importance. Maintenance and reliability are up to gasoline engine standards, he insists.

An agricultural engineer warns that kerosene is safe only when it is cold; any spot that is too hot for your hand is too hot for a can of kerosene, he advises.

Inventions are usually made by men under 40, often without scientific training, is the observation of Sir James Swinburne, president of the British Institute of Plastics.

When you complete a how-to-build project, why not send a photo and description of it to the Editor's Workbench department? Perhaps you will be awarded one of the many cash prizes offered by MECHANIX ILLUSTRATED each month. (See page 10.)

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Black Widow Refuses Bite

Black widow spiders deadly? Dangerous to have around the premises?

Dr. H. A. Allard, scientist in the U. S. Department of Agriculture here, pooh-poohs the whole idea, in the weekly journal, *Science*.

Black widows are poisonous; that he does not dispute. They can make you sick if they bite. The joker is, they almost never bite.

Years ago, says Dr. Allard, he found the spiders very abundant in northern Georgia. Doubting its poisonousness and willing to play guinea pig himself, he tried to make it bite him on the thin skin between his fingers. The obstinate arachnid would not bite.

"On collecting trips as many as five or six were carried in the closed hand on several occasions with no effort on their part to bite," Dr. Allard continues. "The writer has liberated swarms of the young in an old woodpile near his garden, with no fear of being bitten. Much has been written within recent years about the evil ways of this spider, but there is little reason to fear its attacks and no reason to wish that it could be exterminated."

Black widows apparently have the strongly developed maternal instincts often attributed to their human namesakes. At any rate Dr. Allard states that they will adopt the cocoons containing the spiderlings of other females of their species. "If one is dropped on the floor of a box with a female she proceeds to suspend it in a web and watch over it. The process is repeated if others are dropped about, showing a rather marked solicitude for the nest."

Black widow spiders are now on record from all 48 states, Dr. B. J. Kaston of the Connecticut Agricultural Experiment Station at New Haven states, in the same issue of *Science*.

An earlier article by another writer had listed half a dozen states as being still Black-widowless, so far as official scientific records were concerned, including such northern ones as Vermont, Minnesota, and Oregon. These gaps have now been filled. Black widows are probably scarce in these northernmost localities, but can no longer be counted unknown anywhere in the United States.

The Associated Press, a stickler for speed as well as accuracy, gives its newspapers 1939's news, 3,650 hours faster. Reason is the new AP building in Rockfeller Center features the latest-type elevators in the world. Engineers estimate an average saving per man per trip over elevators at two minutes. At 300 trips a day for AP newshawks, that would mean a saving of ten man-hours a day.

A colorimeter is used to take a permanent record of the exact color tone of each painting in the British National Gallery before and after cleaning.

Hand-Made Model Of Famous Cathedral At Fair

One of the most valuable as well as most interesting exhibits of the San Francisco "Treasure Island" Fair is this hand-carved model of St. Peter's Cathedral in Rome, Italy. Complete even to 1,000 carved figures atop colonnades at left and right, the model required more than 200 years to construct, having been started by monks in the 16th century. It has been in the possession of several Popes and Roman families of royal blood and reproduces the famous edifice on a scale of one-inch equals 60 feet.

Test Checks Plane Pilot's Ability To Read Maps

All applicants for non-military flying certificates must now take a special vision test just devised by Dr. Eldridge Adams, chief of the medical section of the Civil Aeronautics Authority, to show how well the pilot-to-be can read printed matter on white and colored paper.

Made necessary by the importance of being able to read without confusion the names of towns and cities on aerial maps and charts, the test consists of reading names and other data in various sizes of type on a chart held 18 inches from the eyes.

It differs from the conventional vision test card in that it is printed in strips of green, white and brown. The regular aerial charts are printed in different colors to show the altitude of the terrain over which the plane is flying.

Names of towns on the test cards are picked at random from all over the United States in order to prevent any would-be cheat from out-smarting the C. A. A. examiners.

The tests have indicated thus far, among other things, that small type printed on a green or white background can be read much more easily than print on a brown background.

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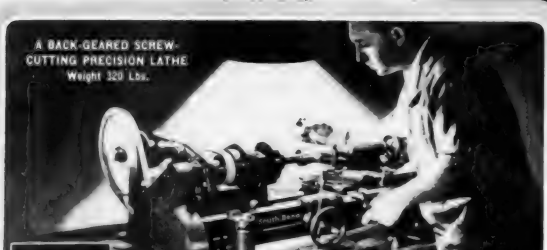

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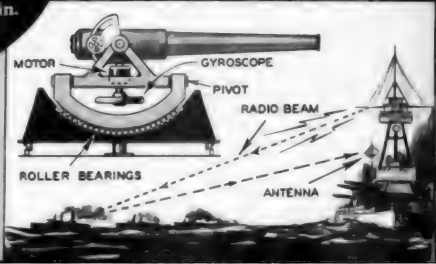
MECHANIX ILLUSTRATED
W. H. FAWCETT
Publishers
Vol. XXII
No. 1
May
1939

Inventor, Incorporated

by
Stanley Gerstin

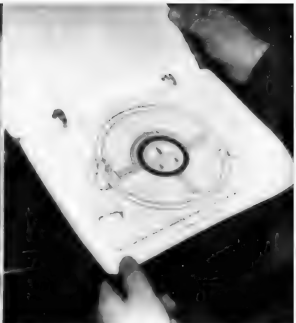
WHAT should the inventor do until the money starts coming in? This is a serious question that has stumped many inventors. But here is the story of one who licked the problem. He is Kenneth P. Hogan, of Philadelphia, an ingenious inventor who got himself incorporated. Three men put up dough for the corporation and sent the inventor into a huddle with himself to invent something. As quickly as Hogan conceived an idea it was designed, patented and sold to a manufacturer. Hogan doesn't have to worry

This is the story of a unique inventor who licked his money problems by incorporating himself to win financial backing until the money starts rolling in.



The drawings on this page depict an idea of Inventor Hogan's for a gyro-type gun-mount for battleships. The mechanism is designed to hold the guns at the angle at which they are pointed, regardless how violently the ship rocks. His special gun-mount is supplemented by a unique range and distance finder employing short radio waves. Read story for working details.

Inventor Hogan is shown above holding his combination nose dropper and atomizer, which merely consists of a metal tube inside the glass tube, and a rubber bulb. It's simple and inexpensive and lends itself to easy production.



When Hogan gets an idea, he makes a working drawing and puts it into his "idea album." Above is shown his plan for placing the speed and pressure gauges in corner post of the steering wheel.

about eating and his incorporators have faith in him as an investment. This may sound like a screwy idea but it works, and what works in favor of one inventor may work for another—it may work for you!

The whole thing happened one day when Hogan returned home discouraged over his failure to interest the Chrysler corporation in some ideas of his for improving automobile accessories (which included a flexible steering wheel). He voiced his lament to a friend who is a noted Philadelphia physician and who occasionally did a little inventing of his own. Most of the doctor's ideas were carried out and put to use in the hospital in which he was interested. The doctor had a shrewd eye for values and recognized Hogan's inventive potentialities.

The physician interested a business man who in turn interested a lawyer and the three proceeded to incorporate the inventor. Hogan was made president of the corporation and the shares were split equally four ways. Hogan does the inventing and selling. The doctor and other business man do most of the financing and the lawyer looks after the interests of all. So far the plan has worked out satisfactorily.

As an inventor, Kenneth Hogan is unique. He carries his ideas in his head and the tools of his trade in his pocket. He has big ideas—and big pockets—and well he might for he

"Topper" is Hogan's most versatile invention. The toy has a gyro in the leg and can be balanced on a tight-rope, drum or flag pole top. Easily made of wood and inexpensive to manufacture, these features endear it to toy dealers.

is a tremendous man, tall and broad, with blue eyes and a square chin. When he visited the writer, his big frame filled the doorway from jamb to jamb and he spoke in a mild Southern drawl that belied his physique. He carried a doll in the crook of his arm. In his fist was a tiny rubber bulb attached to a glass tube which he called an atomizer. He extracted a "circus" from under his coat. I expected him to pull a cannon out of his sleeve.

"About that cannon," he said, "let me explain."

"The Navy is interested in my gyro-type gun-mount for battleships but they want to

see a working model. Now I can invent toys and gadgets and make them from bits of string, a piece of wood and rubber bands with only a pocket knife as my heaviest piece of production machinery, but hanged if I'm in a position to build a cannon! And the battleship to go with it!"

So now Inventor Hogan, who can piece together a new gadget as easily as you or I can knock over a match, is working through a leading experimental laboratory to develop his invention. His special gun-mount uses the gyro principle to maintain the gun on an even keel regardless of how badly or in which direction the ship is rolling. The invention resulted from observations made by Hogan of firing conditions on battleships. He observed that waves roll in the form of a figure 8 and cause the ship to roll in like fashion. When firing a broadside, a ship will roll from 17 to 21 times from the shock. His gyro gun-mount will always keep the gun level and permit more rapid firing as well as more accurate firing. An accessory to his gun-mount is a combination direction and range-finder which operates automatically. Short waves are sent out from the deck of the ship while sensitive receivers slowly revolve in all directions. A short wave that strikes another ship up to 30 miles distance will rebound to the sending ship, somewhat like an echo. The wave is picked up on the rebound and its traveling time is automatically computed to determine the distance between the ships. The direction of the ship is easily determined from the fact that short waves will come back only from the direction of the other ship, so it is claimed. The speed of the vessel can also be determined, as well as its length, simply by noting the point at which short waves begin coming back—follow along the length of the boat and note the point at which they again cease coming back.

Hogan has been inventing things ever since his college days at the University of North Carolina, where he took an engineering degree. Shortly after leaving college in 1918, he invented an auto jack for the Ford car. Hogan sold the jack to a manufacturer who distributed 200 of them. Then Ford changed the design of the wheel and the jack was no good. When still a kid in school,

[*Continued on page* 99]

MANUFACTURERS' GUIDE

Rubber Products
Barr Rubber Products Co., 200 5th Ave., N. Y.
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Fischer Price Toys, Inc., 200 5th Ave., N. Y.

Dolls
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Mechanical and Metal
All Metal Products Co., 200 5th Ave., N. Y.
Hoge Mfg. Co., 200 5th Ave., N. Y.

For further information regarding manufacturers' classifications, write to the editors and they will send you such information if available.

The inventor is shown at work with his crying doll and balancing seal (below). A coffee can, a balloon, a piece of wire and many an the simple materials with which he creates an idea. His workbench is a table top and his tools consist of a knife, screw driver and pliers.

Oxygen Mask Permits Patient To Use Mouth

DEVELOPED as an aid in curing seasickness and other forms of nausea, a new inhalation apparatus features a mask which fits over the nose, leaving the mouth free for conversation or eating, as shown in photo. Two hollow rubber tubes, running down each side of the mouth, connect the nasal mask with a reservoir bag (oxygen) which, in turn, is connected to an ordinary oxygen supply tank.

Non-Sinkable Bathing Suits Demonstrated

DESIGNED for use by swimmers and non-swimmers alike, newly developed bathing suits are made of fabric which is filled with celluloid capsules and a Brazilian weed which is eight times as light as cork, providing buoyancy that keeps the swimmers afloat, as demonstrated at left. In appearance, the new non-sinkable swim suits are similar to ordinary types, being fashioned in the latest modern designs to appeal to the feminine eye.

Scale Model Of Auto Plant Shown At Fair

PLACED on display at the San Francisco Golden Gate International Exposition, a working model (left) of one of the Ford Motor Company plants provides visitors with a visual idea of how raw materials are received and assimilated during the process of manufacturing automobiles. Electrically operated, the scale-model exhibit is said to be one of the most complete industrial displays ever assembled.

Power Saw Operated By Compressed Air

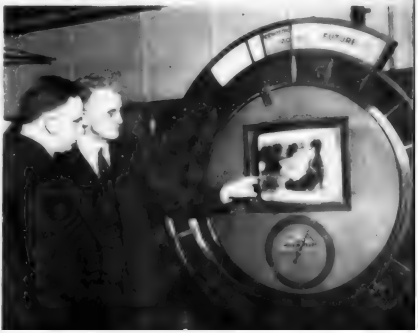
LIGHT enough for one man to carry and utilizing compressed air supplied through a hose leading to a compressor machine, a newly developed power saw is said to do the work of eight men although the services of only two are required to operate it. The compressed air drives the saw blade back and forth at a constant speed while the framework is supported as shown.

"Freezes" Gasoline To Reduce Plane Hazard

DEVELOPMENT of a method of cooling gasoline below the flash point to reduce fire hazard in airplanes during forced landings and electrical storms has been claimed by Assen Jordanoff, well known pilot, shown taking the temperature of a tank full of "gas" which was cooled to 100 degrees below zero Centigrade by use of dry ice and alcohol. At this temperature, the gasoline remains liquid, but must be heated to normal temperature by a special device before it will ignite in the motor.

"Clock" Shows Photos Of Earth's Ages

INSTALLED at the Griffith Park Observatory in Los Angeles, Calif., a Cosmochron, or "clock of the ages," features a bronze hand that revolves around a dial, the outer edge of which is divided into segments representing five geological periods. As the hand passes the segments, a photographic screen in the center of the dial flashes photos highlighting major features of the earth's development.



Makes Soap Model Of World's Fair Grounds

USING an ordinary kitchen knife as his only tool, Ralph Fiordelise, of Philadelphia, Pa., has completed a scale model of the New York World's Fair grounds in soap. Requiring four months to complete, the model covers an area of three square feet and about 500 pieces of soap were needed to carve the various buildings.

Constructs Novel Pipe Organ From Junk

A PIANO, keys and valves from discarded musical instruments and junk in the form of bottles, rubber hose, an automobile inner tube and a vacuum cleaner motor were used by Sidney B. Lubin, of Atlantic City, N. J., to construct the novel pipe organ shown at left. The motor blows air into the inner tube, which stores it as a bellows, and the valves admit the air to rubber tubes which pass it across the mouths of bottles containing varying amounts of water, creating tones of different pitch.

Device Gauges Minute Temperature Changes

TEMPERATURE changes as minute as one-millionth of a degree, which result when acids are formed in water by the decomposition of proteins, can be measured by a newly developed apparatus. Temperature changes in the test solution are determined by measuring the amount of electrical energy required to heat plain water in another vessel to the same degree. An electrically motivated stylus records the changes upon a chart on a greatly magnified scale

THE LATEST FOKKER D-XXI FAMED WORLD WAR PURSUIT SHIP — MAKES AN INTERESTING COMPARISON WITH THE LATEST PRODUCT OF THIS NOTED AIRPLANE DESIGNER
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TANDEM ENGINES./
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20 MM. CANNON
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THIS TANDEM MONOPLANE A FRENCH DELANNE BOASTS TWO SHELL-FIRING GUNS — ONE FIXED GUN FIRES THRU THE PROPELLER HUB, THE OTHER IS FLEXIBLY MOUNTED AT THE EXTREME TAIL. THE DELANNE IS REPUTED TO EXCEED 370 M.P.H.
MACHINE GUN
1,000 H.P. HISPANO-SUIZA ENGINE DRIVES THE PROPELLER THROUGH CAM-SHAFT, WHICH IS HOLLOW
TWIN TAILS./
THE NEW LOCKHEED XP-38 (TWIN V-12 1,000 H.P. PRESTONE-COOLED ALLISON ENGINES) IS THE U.S. REPLY TO PRESENT CLAIMS OF FOREIGN SUPREMACY IN THE FAST FIGHTER FIELD
1,500 H.P. ROLLS-ROYCE ENGINE
BACK SEAT DRIVER./
THE BRITISH AIRSPEED SINGLE-SEAT FIGHTER ADOPTS THIS CURIOUS PERCH FOR ITS PILOT./
Strange War Planes

Model Shows Future Airport

SHOWN above is a model of a combination city building and airport of the future, which was designed by Wilfred Yapp, of Detroit, Mich. The roof top airport design features a turntable landing strip which can be headed into the wind to facilitate the landing and takeoff of aircraft.

Simplified Diving Apparatus

STRAPPED on the back like a pack and weighing about 30 pounds, a new underwater diving apparatus functions without a pump, the oxygen supply being fed to the divers' face mask by an automatically-operated built-in "lung." Good for a two-hour immersion in shallow water, the equipment enables the diver to descend to depths up to 40 feet for periods of one hour.

Riderless Bike Shown At N. Y. World's Fair

A RIDERLESS bike, which is fitted with balance weights controlled by an "electric eye" receiving light energy from a mirror on the bike's frame (dotted line), is on exhibition at the New York World's Fair. The front wheel is motivated and steered by an electric motor, providing a gyroscopic effect, and if the bike is tilted the light beam is upset, causing the weights to change position so as to restore the bike's balance.

Button-Type Control Board Runs Model RR

DEVELOPED by O. M. Cooksey (above), of Louisville, Ky., a compact model railroad remote control board enables the operator to switch trains, couple and uncouple cars, etc., merely by pressing buttons.

Powered "Dust Pan" Sucks Up Stones

DRIVEN by a one-horsepower gasoline engine, the new vacuum-type "flying dust pan" shown above can suck a factory floor clean of dirt and debris, from fine dust to stones as large as hen's eggs, at a speed of three miles per hour.

Airplane Climbs 5,000 Feet In 1.6 Minutes

POWERED by a 600-horsepower radial air-cooled engine, a newly developed Air Corps airplane can climb to a height of 5,000 feet in 1.6 minutes. Known as the CW21, the plane cruises at a speed of more than 300 m.p.h. at 17,500 feet (right, upper photo).

Modern Miracle:

Left: John Wesley Hyatt, inventor of celluloid, accidently started a chemical industry that has grown to tremendous importance.

Right: Celluloid, since its invention shortly after the Civil War, has been converted into many products. Lumarith, another synthetic product produced by the Celluloid Corporation, is the material used for making the cashiers shown in the picture. There is hardly a household that does not have some utility article made from plastic.

by John E. Pfeiffer

THE stem of your pipe may be attractive and look like amber. Your radio may have the shining surface and color of mahogany, and your eye-glasses may have a frame that seems to be made of real tortoise shell. But the odds are you are simply one of the millions of persons who use plastics every day of their lives.

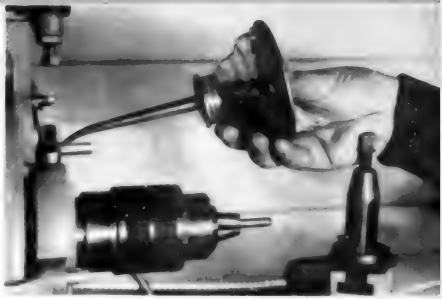
The hard, durable substances are the favorite children in the ever-growing synthetic-chemistry family. There are more than 600 companies engaged in making the rugged substitutes for stone, wood, metal, bone, and other materials, and the value of their annual production is well over $40,000,000! Just as your grandparents acquainted themselves with such now-famous products as "B.V.D." and "Kodak," you have probably learned to reel off the trade names of certain plastics like "Celluloid" and "Bakelite." But you and your children may soon have a far larger plastic vocabulary; words like "Lucite," "Tenite," and "Plaskon" promise to be incorporated into everyday English.

In the modern sense, all plastics are alike in that they are not found in underground mines or any other natural state, but are built up molecule by molecule by chemists working overtime in industrial laboratories. Furthermore, all plastics can be molded like wax or clay into definite shapes and will keep their forms after the molding process is finished. Here the similarities end, however. From now on plastics are on their own and may differ as much as any two human beings.

The first thing to ask if you want to know something about one of these new materials is, "Is it animal, vegetable, or mineral?" Animal plastics may be made out of extracts of sour milk. Vegetable plastics come from peanut shells, soybeans, wood pulp, cotton, and a host of other plant products. The so-called mineral plastics are developed from such common laboratory reagents as carbolic acid (phenol) or they can be formed from the old synthetic standby—coal tar. Other mineral plastics are concocted from compounds made up from the intangible gases that compose the air you breathe. But whatever the source, you can't get away from them, and last year more than 120,000,000 pounds were manufactured in the United States alone. Already an estimated 50,000

The Secret of Plastics

This is the second of a series of articles on synthetic chemistry. It tells how celluloid, the first plastic developed by science in the laboratory, was produced from vegetable compounds.



Synthetic plastics have invaded the workshop as well as the kitchen. Now shopmen can see the oil level in transparent oil cans made from Celluloid's all-purpose "Lumenith."

uses have been found for the solid materials.

The first synthetic laboratory plastic was a vegetable product which started from humble beginnings and was indirectly connected with the elephant situation in India and Africa in 1868. Billiard players were in a bad fix. They wanted to set up more tables all over the country—but there was a shortage of ivory for billiard balls. The situation became so desperate that a New York firm offered $10,000 to anyone who could discover a way of making artificial non-ivory spheres for cue enthusiasts. The offer attracted the attention of John Wesley Hyatt, owner of a small printing shop in Albany, and with his brother Isiah, he set out on the trail of a synthetic billiard ball. As a billiard-ball manufacturer, Hyatt was a dismal failure. His plan to compress a paper fiber-shellac mixture into a sphere and coat it with some ivory-like substance didn't even come close to winning the prize. But he did invent a material that had never been known before and that is now to be found all over the world —Celluloid.

John Hyatt was a blacksmith's son and didn't have much formal education in chemistry, but he had a native talent for the science and an eye for the practical. He obtained the cellulose which duPont and other companies now use for making rayon from waste wisps of cotton, and mixed it with nitric acid and other chemicals. By properly applying heat, Hyatt ended with a cellulose-nitrate fluid that hardened upon cooling, and to which he gave the trade name Celluloid.

Automobile hardware molded from plastics is attractive and inexpensive. Note various molded designs (right).

In the compression molding technique, plastic material is placed in a preforming machine that punches it into pellets at the rate of 60,000 an hour (left). The pellets are then placed in specially hardened steel trays, heated and compressed into the desired shape (see right). In the case of cellulose-acetate plastics, the machines are cooled with water, and the stamped product removed, trimmed, polished and sorted (below).

Under pressure the soft, thick syrup could be put into molds and hardened. The young printer immediately set up his Celluloid Company in Newark, N. J.

Celluloid, the Grand-Old-Man of plastics, was and still is a great trickster. Clever processing methods treat it to look like ivory, tortoise shell, mother of pearl, onyx, rare woods, lapis lazule, and marble. It is tough enough to be used in golf club facings, mallet heads, shoe-lace tippings, and toothbrush handles. But the pioneer substance is gradually being replaced by the so-called cellulose-acetate plastics, which are cheaper to make and don't have Celluloid's main drawback, inflammability.

Celluloid burns rapidly and is closely related to guncotton, a substance used in explosives. In fact, guncotton contains 14 per cent nitrogen while Celluloid with an 11 per cent nitrogen content is only three percentage points away from being an explosive itself. So chemists started on the hunt for a non-burning plastic, and researchers at the Tennessee Eastman Corporation found it first. The substance, called cellulose-acetate, is made by mixing cellulose with acetic acids instead of nitric or sulphuric acids, and burns about as slowly as wood. This type of plastic is now known by such trade names as Fibestos, Lumarith, Plastacele, Tenite and others.

Cellulose-acetate was first used for airplane "dopes" (substances that make airplane wings taut and air-tight), non-inflammable films, and artificial bristles for toothbrushes and hairbrushes. By taking a soft cellulose-acetate mixture and rolling it into large sheets, workers produced the now-famous Cellophane on a commercial scale as far back as 1908.

Sixteen years later duPont got hold of it and as the transparent paper began to appear on everything from cigarette packages to chocolate layer cakes, it made millions of dollars in clear profits during the depth of the depression. But cellulose-acetate as a

solid stuff used for ash trays and thousands of other conveniences is a more recent development.

Before the depression less than 2,000,000 pounds of cellulose-acetate plastics were made annually. Then came the slump—and with it the beginning of a rapid increase in demand for these materials. Production soared to nearly 3,000,000 pounds in 1933, and today the industry is well over the 13,000,000 mark. Helping to swell cellulose-acetate totals is the automobile industry, which uses the plastic—dyed to various brilliant colors—for steering wheels, dashboard panels, door handles, and gearshift and control knobs. Other uses include radio dials, golf tees, gun butts, toy airplanes, dominoes, poker chips, necklaces, bracelets, and rings.

Cellulose products are made in several ways. The pure plastic may be distributed in slab form to manufacturers who want to grind, shape, and polish it. Or the material may come in a powder form, in which case it will be molded in special machines. But before this process takes place, some producers put the plastic through a "pre-forming" routine. The plastic falls into die cavities and is pressed by a descending punch to a "pill" or "pellet." While the single-punch type of preforming press makes about 3,000 pills an hour, high-speed rotary pre-formers can make as many as 60,000 pellets in the same time.

There are two chief ways of molding plastics. In compression molding, the pellets are placed into specially hardened steel molds, say, in the shape of bottle caps. Then the pills are heated into a thick fluid and squeezed by pressure averaging 3,000 pounds per square inch. Since cellulose-acetate plastics must cool to harden, the molds have to be chilled with cold water. The entire process may take only two or three minutes per article, but many things can happen to upset things. When the plastic is in the mold, things are under perfect control, but the minute workers try to remove the shaped materials, irritating and often uncontrollable chemical changes may spoil the product. Some removed bottle caps may have "blisters" on them; others may crack or warp; still others may show a peculiar "frog skin" surface. There are about 15 possible flaws, 59 things that might cause them, and 78 suggested remedies to gray the hairs of

[*Continued on page 93*]

Plastics are also available in powder form and are molded in special machines. Powder is poured in the mold (top), placed under terrific pressure and removed when cool (see above). Pre-forming method illustrated on opposite page is a variation of this process.

The injection pressure machine (right) is breaking all records for production of plastic articles. It has been predicted that some day such a machine will cast a bathtub in one big splash—complete—but without beaker!

Building A "Cloud Chaser"

Above—Designed by Hawley Bowlus, who is said to have taught Col. Charles Lindbergh the art of soaring e glider, the "Baby Albatross" sailplane presents a novel appearance in flight due to the fact that it features a short streamlined nacelle for the pilot instead of the conventional lengthy fuselage. The tail unit is attached to the nacelle by means of a metal boom. Right—The cockpit contains three instruments—an air-speed indicator, altimeter and rate-of-climb meter. The pilot's hands are gripping the half-wheel control that governs banking, climb and descent of glider.

Above—Forming the nacelle, or body, of the "Baby Albatross." The plywood for the body is placed in the mold in a moist condition after which an air-filled rubberized balloon is placed atop the plywood. The upper section of the mold is then lowered against the balloon and pressure applied until the plywood dries, assuming the desired shape. Right—Interior view of the Bowlus factory in San Fernando, Calif., showing partially finished wings. Bowlus, rated as one of the world's best glider pilots, is shown carrying a glider nacelle, which weighs about 28 pounds. The "Baby Albatross" is sold completely assembled for $750 or in knocked-down kits for $400.

New "Tell-Tale" Device Simplifies Pilot's Job

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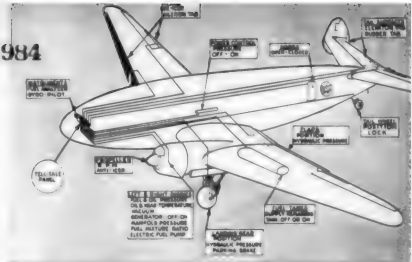
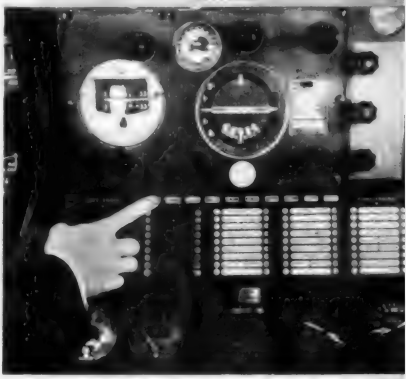


DESIGNED to simplify the pilot's operation of a giant, new, multi-motored, sub-stratosphere type 30-passenger Curtiss-Wright transport airplane now nearing completion in St. Louis, Mo., a specially developed "Tell-Tale" device (right) automatically checks the functioning of all instruments and vital parts of the plane and, supplementing the so-called Sperry "automatic pilot," greatly eliminates "pilot fatigue" with its resultant errors in operation.

Connected to various parts of the plane (sketch), the "Tell-Tale" device is essentially a panel of lights in full view of the pilot. The pilot simply presses a pre-selector switch corresponding to whatever operation he requires and a battery of lights on the panel immediately indicates any necessary controls or instruments which must be adjusted. As the latter are properly manipulated, the corresponding lights on the panel become darkened, indicating proper functioning.

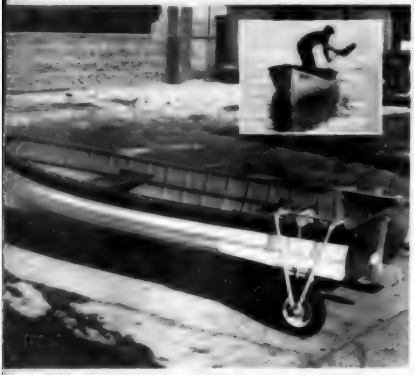


Public Machine Sends Facsimile Telegrams

HOUSED in a small cabinet, which fastens to a wall, a newly developed automatic telegraph machine enables the user to transmit a telegram as easily as dropping a letter in a mailbox. The message need only be typed or written on a telegraph blank and dropped into a slot in the machine, as shown in photo, whereupon it is automatically wrapped around a transmitting cylinder revolving before a photo electric cell and a facsimile is transmitted to the nearest main telegraph office.

Wing Of "Flivverplane" Supports 18 Men

PROVING the strength of its wing structure, the photo at left shows 18 men seated upon the wing of a Piper "Cub" airplane. Note that the tires have flattened under their combined weight, approximating 2,800 pounds. Powered by either a 40 or 50 horsepower air-cooled engine, the "Cub" is rated as the most popular lightplane in America.



New "Trailer-Boat" Is Hauled By Car

THE unique "trailer-boat" shown on the left is equipped with permanently-installed retractable wheels at the stern, and is easily hauled by any light passenger car by means of a trailer hitch on the bow. The craft is merely pushed into the water on the wheels, and the latter are then folded back (as indicated by small insert photo) when the boat is floated. It is 14½ feet long, has a 5-foot beam, seats four to six persons, and is powered by a special inboard mounted motor. Maximum speed is 10 m.p.h. When not in use, craft is stored in garage.

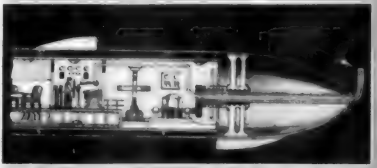
Collection Of Fishing Tackle Worth $10,000

VALUED at $10,000 and numbering 11,000 pieces, a collection of fishing lures and tackle owned by J. C. Seaman, of Cleveland, Ohio, is believed to be the largest private collection of its type in the country. The novel collection is comprised of flies, plugs, rods and reels which Seaman gathered together during a period of 14 years.

Tomorrow's Inventions

PLANS for a speedy submarine "screw-ship," which would serve as a carrier for the quick dispatch of mail and freight between continents, have been developed by Maximilian Bernd, an engineer in Hamburg, Germany. Resembling a torpedo in general appearance, the proposed underwater craft consists of two parts. One, a cylinder-like inner chamber, features the crew's rooms, the storage hold, engines (electric) and a gyro device to maintain balance. The other part of the future "screw-ship" consists of a steel outer jacket which rotates around the stationary inner chamber by means of a special gear and bearing arrangement and which has spiral-shaped metal fins fastened to its surface. When the engines cause the outer jacket to rotate, the spiral fins screw into the water much as the threads of a screw bite into wood, thus forcing the craft forward. A periscope at the nose and a rudder at the rear facilitate steering.

Above—A look into the future! The first submarine "screw-ship" arriving with mail and express after crossing the ocean in less than one day.



Above—Cross-section of proposed "screw-ship" showing inner stationary chamber, which houses machinery, crew, gyro, etc., and the outer jacket which revolves around inner chamber, providing propulsion by means of spiral fins, as sketched below. Gyro keeps inner chamber level during trip.

Electric Track Device Starts Runners Fairly

ELIMINATING the chance of one track runner starting a split second before another, a new device consists of a revolver which is electrically wired to contact plates under the runner's hands (arrow). Should he start prematurely, the electric circuit to the gun is broken when he lifts either hand, making it impossible to fire the gun and officially start the race.

Model Of Non-Sinkable Lifeboat Demonstrated

A MODEL of a non-sinkable 50-passenger all-metal lifeboat, which automatically rights itself regardless of how rough the water, was recently demonstrated in New York, N. Y. Invented by Charles Farrugia, a 29-foot lifeboat patterned after the model would be powered by a gasoline engine and feature a completely decked over hull with watertight hatches. Separate cowls would provide an ample supply of air for the passengers and engine. Complete radio equipment would be carried.

Short-Turn Tractor Has Adjustable Frame

SPECIALLY designed for general utility work on farms, a new tractor features a frame which can be adjusted from 48 to 72 inches in length and from 60 to 70 inches in width. Powered by a gasoline engine, the 2400-pound tractor has a draw bar pull of 1,500 pounds at a speed of 4½ m.p.h., can attain a speed of 20 m.p.h. and turns in its own length (insert) as a result of individual drive wheel control.

Aircraft Radios Get "Torture" Test

In the pressure tank shown at right, aircraft radios are subjected to a test designed to prove their ability to operate at various altitudes. Vacuum pumps reduce the interior pressure of the tank to a degree simulating that encountered by a plane flying at 30,000 feet. Below—For a 96-hour period this humidity chamber "tortures" the radios with temperature extremes ranging from desert heat to arctic cold, revealing faults in many parts. Throughout the 96 hours, operating tests are made and the units must perform normally to pass the critical inspector's check.

The shock-proof qualities of aircraft radios are checked by dropping them onto a rubber mat (above) from a height of 18 inches not once, but 100 times! Below—Aircraft radios must survive a four-hour test on this electrically operated "shake table" to be acceptable. An special eccentric gears create a vibration that tears ordinary radios apart in a few minutes.

by Byers C. Rathbone

BEFORE major air lines will accept radio equipment for installation aboard their huge transport planes the receivers, transmitters, antennas and other radio aids are submitted to gruelling laboratory tests to determine their ability to withstand varying atmospheric conditions, shock and vibration. In the shops of a builder of communications equipment in Kansas City, Mo., several unusual machines have been developed to

[*Continued on page* 98]

Our Air Force—A Farce!

"We are five years behind England and Germany in planes, engines and equipment and a full 10 years behind in the development of our air force as a third arm of defense."

by Major Al Williams

Top: This strange looking craft is the sensationally new Lockheed XP-38 mid-wing monoplane equipped with twin Allison liquid-cooled engines. The double-fuselage plane was built experimentally for the Army. Officially called the newest and fastest fighting plane, this photo was taken just prior to its take-off for what proved to be a near-record cross-continental flight made in slightly over 7 hours.

Above: This is a single-engine Curtiss XP-40 equipped with an Allison liquid-cooled motor. It is one of the newest single-seat fighters built for the Army and is claimed to have a top speed in excess of 400 miles per hour.

AMERICA is not an airpower!

We have, instead, two flying services—one with the Army and the other with the Navy—and they are not adequate for the defense of the nation.

As airpower goes, I estimate that we're about five years behind Europe's leaders in planes, engines, and equipment, and a full 10 years would be needed for the maturity of a brand new service. This goes in spite of a European demand for American fighting ships, in spite of "downhill" speeds of from 575 to 700 m.p.h. claimed for blunt-nosed radial engined planes, and in spite of a college-student civilian training program which portends to be a solution to the pilot problem.

Our air-cooled engines are good, and hold their own with foreign radials. Our ships came in handy in the scramble for planes after the Munich incident; they are fill-ins for building programs that weren't geared to air war. But they are powered by engines which can't approach the English Rolls-Royce streamlined power plants, for instance, and none of the planes is in the same speed bracket with standard fighting ships of the airpower nations.

In my opinion, the most significant development in American military aviation in recent years came recently when the Army super-speed XP-38 Lockheed streaked across the continent in a little more than seven hours. That plane was powered by two Allison streamlined, liquid cooled engines, and it could mark the fulfillment of enduring prophecy and the beginning of America's true performance in the air. It picks up speed research where a little Navy biplane left off 16 long years ago.

The biplane was a sleek, streamlined little ship powered by a Curtiss D-12 engine, an in-line and water-cooled plant. It slid through the air with less resistance than any ship of its period, and its record of 266.6 m.p.h. was made when no service plane was tipping 150. I flew that ship to its laurels, and its speed stood briefly as the world's record and for eight years as the American speed record. It stood as our record for so long because the reactionaries, headed by the then Assistant Secretary of the Navy for air, declared that 266.6 m.p.h. was all the speed we could use.

Jimmy Doolittle, of the Army, (I, then a pilot for the Navy), and many other ambitious youngsters envisioned speeds of 300 and 400 m.p.h. and up and were anxious to fight for them. We lost out, though, and first the Navy and later the Army abandoned the in-line engines in favor of the radials. Never since has the United States held the world's speed record, which at present is held by Italy at 440 m.p.h.

The new type twin-engine Army ship hasn't brought us out of the woods, although it does blaze a trail. It isn't "probably the fastest in the world," as announced at the time of its appearance. Last summer I flew one German ship whose prototype approached the top speed claimed for the Lockheed, and saw

Above: Official Army photo of the Curtiss Y1A-18 powered with two single-row, 9-cylinder Cyclone engines. This attack job was recently tested by the 3rd Attack Group, G.H.Q. Air Force.

Above: This small low-wing monoplane, known as the "Interceptor" because it is intended to intercept bombers before they reach their destination, is an Army experimental job built by Curtiss. Equipped with a super-charged 600 hp. motor, the plane will climb 5,000 feet in 1.6 minutes. Speed is 304 m.p.h. at 17,000 ft. Armament consists of two machine guns.

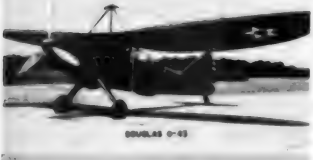
Above: Seversky P-35, single-seat fighter monoplane equipped with 950/1000 hp. Pratt & Whitney, 14-cylinder radial engine. Top speed at 10,000 feet is 300 m.p.h. Cruising range is 1200 miles. Armament consists of two machine guns and light bombs.

Below: U. S. Army official photograph of the Boeing XB-15 "super-flying fortress" being tested by the Army. This air-giant is powered by 4 one-thousand horsepower engines built by Pratt & Whitney. Largest of the bombers designed for our air force, it is for long-range flying.

Below right: Northrop A-17, two-seat attack monoplane with detachable wing-tips. Equipped with 750 hp. radial engine. Top speed is 310 m.p.h. Climbs 2,500 ft. /min.

Above: North American BT-9 is an Army two-seat advanced training monoplane equipped with a 400 hp. Wright air-cooled engine. Maximum speed is 171 m.p.h. and landing speed is 56 m.p.h. This plane is especially equipped for training in blind flying.

Above: Major Al Williams is shown beside his famous Navy Curtiss racer equipped with a Curtiss D-12 liquid cooled engine, in which he won the Pulitzer race at St. Louis in 1923, with a speed of 266.6 m.p.h.



Above: The Douglas O-43 is a two-seat Army observation plane. It is a wire-braced "gull-winged" monoplane with 675 hp. liquid-cooled Curtiss Conqueror engine. Top speed is reported at 160 m.p.h.

Above: Curtiss A-12 two-seat attack, low-wing monoplane designed for the Army. It is equipped with a Wright "Cyclone" 9-cylinder, 730 hp. engine and has a top speed of 192.9 m.p.h. It has four machine guns.

another type which outdid it by 35 m.p.h.

It isn't 100 miles an hour faster than single-engined foreign ships, and I know that from time at controls, too. It isn't an innovation, for upon my return from Europe last summer I reported a twin-engined, streamlined fighting plane—also a single-seater—which can outdo the aerobatics of any single-engined plane.

But the new American ship is a tribute to the Army Air Corps' initiative and to the perseverance of the Allison Engineering Corp. It's an example of what should be going on all over the country, for speed is the essence of airpower, and research is the only way to speed. And even after a good engine is developed, a long period of teething trouble is ahead of it. It's a hard grind from the experimental stage to the standard fighting ship rating. In all these things, we trail Europe.

Our nearest approach to actual air power lies in the General Headquarters Air Force.

Before 1935 the Army Air Corps was scattered throughout the country, and in charge of nine different Army Corps Area commanders—all generals of infantry, cavalry, or artillery. As could be expected, they operated as nine separate forces. If the pilots of the first pursuit group at Selfridge Field, Michigan, wanted to fly to New York, for instance, they had to get permission from the Corps Area Commander. The GHQ Air Force was established in 1935 as an experiment. Later, when Major General H. H. "Hap" Arnold took over control of the Army Air Corps in 1938, he said he was going after some faster fighting planes. He meant business, as witness the new twin-engined

Left: Brewster XF 2A-1, Naval shipboard experimental fighter. It is a mid-wing, all-metal monoplane equipped with completely retractable landing gear. Armament consists of two machine guns in top cowling.

Above: Official U. S. Army Air Corps photo of the Martin B-10 bomber designed for the Army G.H.Q. Air Force. This mid-wing job is equipped with two radial engines and is designed especially for service on the Pacific Coast.

streamlined Lockheed. He's dug into the defense problem with his "blackout" rehearsals, and the long range work of his corps is best attested to by the "Flying Fortress" flights to South America.

I've got a lot of respect for "Hap" Arnold. He flies his own ship, and that dates back to 1911. He's a flying man's pilot, and a flying man's executive.

The GHQ force illustrates the merit of a separate air force, but it isn't a separate air force in any sense of the word. It's a compromise, and it provides the reactionaries with a handy answer for air power appeals without stripping the control from their hands. While the force nominally operates under its single command, it nevertheless is subordinate to the General Staff and is restricted to land operation. (The Navy's jurisdiction prohibits the Army force from flying more than 100 miles to sea.)

The GHQ Air Force is dependent on a parent service, but it isn't living in the same house. That little taste of independence and opportunity for initiative has produced results, and gives us a glimpse of what our air force should and could be.

Each time our fighting aviation services have shown promise of being able to run a war independently of the land and sea forces, Army and Navy leaders jumped on the idea and pushed our errand boy aviation back to its original status. That's where it is today and whether our Army and Navy can be compelled to acquiesce to any reorganization is the first "question" in the popular desire for air protection.

[*Continued on page* 101]

Right: Northrop BT-1, two-seat dive bomber monoplane equipped with 750 hp. Pratt & Whitney engine. Designed as a Navy attack ship; performance figures are confidential. Note that landing gear is partly retractable.

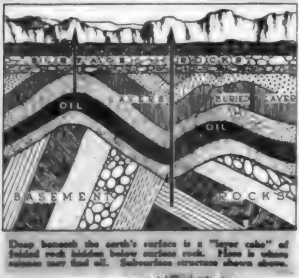
Above: Curtiss SBC-3 two-seat scout bomber designed for the Navy. This biplane is equipped with a Pratt & Whitney radial engine. The Navy purchased 141 such planes and is keeping performance figures a secret.

Above: Consolidated's experimental patrol bomber XPB2Y-1 designed for the Navy and equipped with four 1,050 hp. Whitney "Twin-Wasp" engines. Pilot's compartment is near leading edge of wing. Gunners in nose and stern; navigator amidship. Equipped with sleepers and kitchen. Details of arrangement and performance factors are held confidential by Navy.

Above: Grumman F3F-1 developed for the Navy and equipped with a 650 hp. "Twin-Wasp Junior" engine. Maximum speed is 260 m.p.h. at 7,500 ft. Landing speed 65 m.p.h. Two fixed Browning machine guns are mounted to fire through the propeller.

Science Seeks Hidden Oil

This is the latest instrument used by geophysicists to analyze artificial earthquake waves which tell where hidden oil reservoirs may be found between deep layers of rock.



Deep beneath the earth's surface is a "layer cake" of folded rock hidden below surface rock. Here is where science may find oil. Subsurface structure shown above.

GEOLOGISTS are turning once more to a trick of their trade—"layer cake" geology—to postpone the renewed threat that the world is going to run out of oil. Science expects to gain this end by studying the "layer cake" formation of the earth.

Dr. A. I. Levorsen of Tulsa, Okla., former president of the American Association of Petroleum Geologists, insists more oil will be found. He claims that in many parts of the country the surface rocks were deposited on top of folded, broken, altered older rocks, which, during the almost measureless time since they were deposited, were smoothed on the upper surface.

These older rocks resemble a layer cake that has been bent and twisted. No trace of these complicated folds show on the surface, nor in shallow drilling or ordinary geophysical exploration. In these folds and domes may be oil.

These hidden pools may be found by sensitive geophysical surveying instruments, specially made to detect small differences between folded and flat rocks a mile or more beneath the surface. (See photo top left).

"Layer cakes" aren't the only new thing in geology, Dr. Levorsen points out. Changes in the number and size of the pores in a single bed of rock can cause oil to accumulate on certain places. If a bed starts out as sandstone, and changes within a few miles to shale, which has fewer pores, and then to a limestone, which has almost none, oil will tend to accumulate in the porous, sandy part of the bed and not in the shale and limestone. Often a wedge-shaped bed of sandstone, surrounded by shale and limestone, is found in a single level, unbroken formation. Chance, use of geographical instruments or possibly study of changes in tiny fossils may be the only way of finding oil.

This is a bird's eye view of a California oil field of today. Science ponders the question: "How long can these wells suck oil from mother earth?"

New Lightplane Has Steerable Nose Wheel

BELIEVED to be the first modern lightplane equipped with a tricycle type landing gear, the front wheel of which is steerable, a newly developed low-wing monoplane features all-metal construction, except for fabric covering on the outer wing panels. Powered by an inverted, in-line, air-cooled engine of 60-horsepower, the plane carries two passengers, seated side by side, and has a top speed of 101 m.p.h. The monocoque type fuselage is 18½ feet long and is made of aluminum alloy. The wingspan is 30 feet. Note the twin rudder assembly.

Biggest Tire, Smallest Scraper Star At Fair

THE photograph at right shows the world's largest tire—96 inches in diameter, 39 inches wide and weighing 1,600 pounds—serving as a background for the world's smallest dirt scraper machine, a ¼-inch-scale working model, which has been placed on exhibition at the San Francisco World's Fair. The model scraper is an exact reproduction of a machine that handles 27 tons of dirt at one time.

A Pick-Proof Lock?

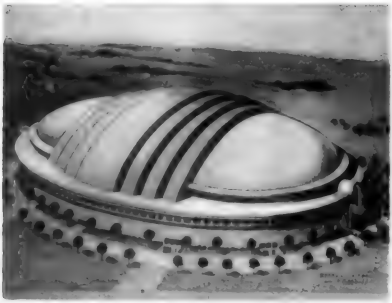
REQUIRING no key or keyhole, an electrically operated lock invented by Edmond Michel, of New Orleans, La., is claimed to be pick-proof, although locksmiths have stated for years that such a lock could never be developed. The new lock is opened by pressing a certain combination of buttons, which creates the proper electric circuit that automatically trips the catch.

Builds One-Passenger "Power Cruiser"

CLAIMED to be the world's smallest "power cruiser," the novel boat shown at left carries her designer-owner W. H. Lettelier, of Los Angeles, Calif., through the water at a speed of 6 m.p.h. Powered by an engine of only ¾-horsepower, the tiny craft has a beam of 28 inches, draws 6 inches of water and is 8 feet, 3 inches in length. The cruising range is about two miles. The little boat is an exact replica of a 33-foot powered cruiser.

Lake Yields Tons Of Valuable Lead-Shot

USING home-built suction-type salvaging equipment (left) to recover lead-shot from a nearby lake where about 150 tons has accumulated as a result of the activities of sportsmen engaged in shooting clay pigeons, two former unemployed men in Denver, Colo., have created a paying business. From 2,000 to 3,000 pounds of lead-shot are recovered daily and the men sell it to local smelters for $65 per ton.



Detroit Plans Stadium For 1948 Olympics

DETROIT'S Olympic Games Committee, which seeks to bring the athletic spectacle to the Michigan city by 1948, has drawn up plans for a stadium (left) in which to hold the international competition. The proposed stadium features a roof of novel design which would cover an oval field, 340 feet by 700 feet in size. Accommodations for 100,000 spectators would be provided and construction would cost about $1,500,000.

High-Wing Douglas DC-5 Transport Plane Makes Bow

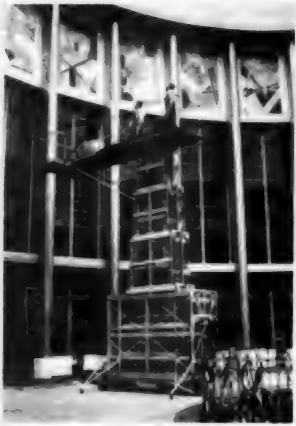
CARRYING 16 passengers and a crew of three, the twin-motored Douglas DC-5 is the latest type of transport plane developed for airline use. The new airplane's high-wing design enables passengers to obtain an unobstructed view of the terrain being flown over.

Golf Device Gives Practice

ATTACHED to a rubber hinge, which can be fastened to the wainscot panel of a room, a new golf ball device (below) enables a player to practice indoors. No matter how hard the ball is struck, it cannot free itself.

Wheel Motor Drives Scooter

DEVELOPED in Berlin, Germany, the powered scooter shown above features a specially designed air-cooled engine which is attached to the front wheel fork. A gear arrangement between the motor and wheel enables the scooter to travel at a top speed of about 20 m.p.h.



Scaffold Is "Jack-In-Box"

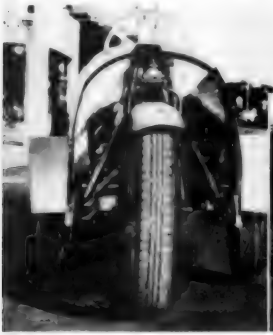
USED for cleaning and maintenance work in buildings that have lobbies with high ceilings, a new electrically operated platform device (above) is comprised of eight telescopic aluminum frames and lifts two men from a minimum height of eight feet to 45 feet at the rate of six feet per minute.

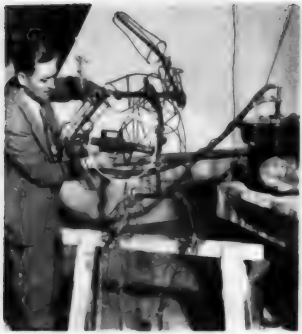
Stuffed Bronco Is Photo Gag

PROVING that you can't always believe your eyes, the photo above shows a roadside photographer in Rapid City, S. D., taking a picture of a customer astride a stuffed horse in a typical "ride 'im cowboy" pose. The novel "prop" is said to have created considerable business for the photographer.

Invents Two-Wheeled "Auto"

DEVELOPED by J. Grady Tingle, of Miami, Florida, a new type of vehicle (below) features two main wheels similar to those of a motorcycle and two smaller retractable sidewheels, which are let down to prevent tipping (left) when the "auto" is slowing for a stop. A four-cylinder air-cooled engine provides power for the novel car.





Invents Pistol-Type Welder

A PISTOL-TYPE electric welding apparatus (circle) which completes 20-25 spot welds per minute, has been invented by Delmar Gray, of San Francisco, Calif. The welder has a grip squeeze that clamps the electrodes over the joint to be welded, eliminating the necessity of holding the wires with the hands, while the current is turned on merely by pulling the trigger. The welder was devised specially for use on heavy wires used to construct skeleton frames for mechanical dummies.

Torque Wrench Has Built-In Warning Light

A NEWLY developed torque wrench features a built-in battery-operated light that flashes (right) when a pre-set tension is reached, thus eliminating the danger of applying too much force when tightening nuts. The wrench also has a dial which indicates the amount of tension being applied at any time.

If you are interested in any of the items mentioned in this issue, send a stamped, return envelope for the address of the manufacturer or inventor.

Magnet Is Ultra-Powerful

SMALLER than a pencil eraser in size and made of a special alloy, a newly developed permanent magnet can lift a flat iron weighing over five pounds (above), which is 1,500 times its own weight. Insert photo shows the magnet with the steel jacket that protects it against demagnetization when not in use.

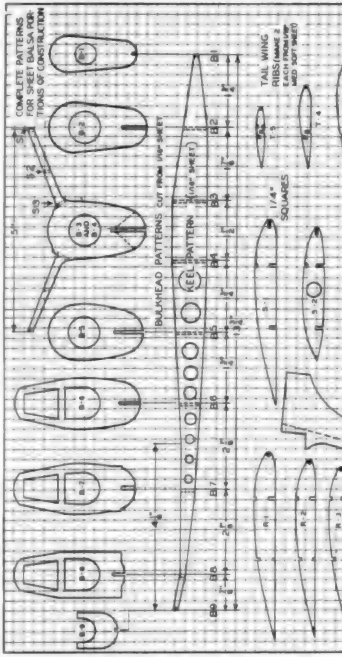
Build and Fly this Miniature

by

Douglas Rolfe

THE Delanne cannon-plane is France's latest thing in multi-seat fighters. Featured on the cover and elsewhere in this issue of MECHANIX ILLUSTRATED, the Delanne differs so radically from conventional military types, that the editors thought our air-minded readers would like to have plans for a flying scale model of this interesting airplane.

The Delanne is really a tandem monoplane—the front wing is high, with gull-wing roots; the rear wing, which takes the place of the normal stabilizer, is of the low-wing variety and not only has a pronounced dihedral, but also considerable sweepback. These features lend themselves admirably to flying model requirements. The wings provide ample surface without excessive span, and the sharp dihedral of the rear wing ensures stability without resorting to the customary distortion of the main wing dihedral. Twin rudders are mounted on the extremities of the rear wing.



A few minor details, such as the motor banks and forward machine guns, have been omitted in the interests of performance, but they can be added if the builder wishes. Bulkheads are created directly with sheet balsa, eliminating the necessity for stringers, and making a neat, strong fuselage. With the exception of the enlarged propeller for flying, this model adheres faithfully to the proportions and design of its prototype.

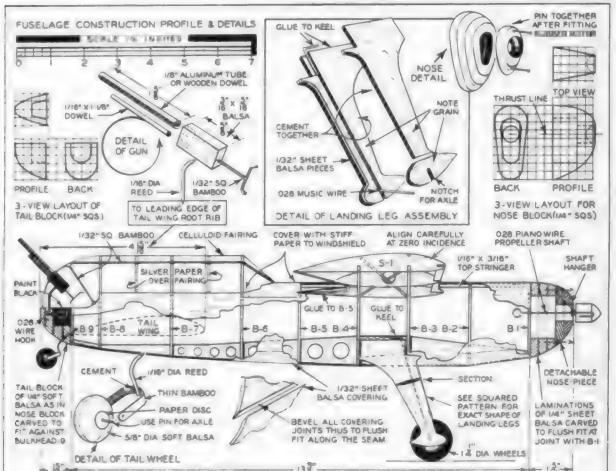
Building the Model

The materials required are simple. They include small

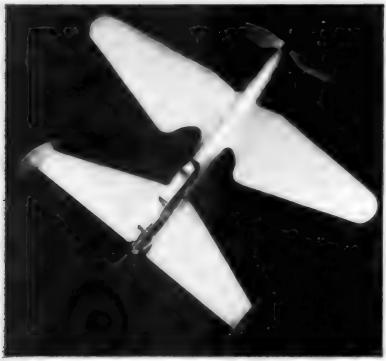
New French Cannon-plane

amounts of $\frac{1}{16}$" and $\frac{1}{8}$" strip balsa; $\frac{1}{32}$", $\frac{1}{16}$" and $\frac{1}{8}$" sheet balsa; a short length of bamboo and one sheet of silver tissue. Two tubes of model cement; three bottles of clear dope and one bottle of silver dope; two yards of $\frac{1}{8}$" flat rubber and some odd lengths of .028 piano wire just about complete the list. For those builders who don't like the drudgery of carving out their own propellers, any 8" standard 2-bladed, or 7" 3-bladed propeller is recommended. The model shown has a 7½" diameter propeller but eight inches is the usual purchaseable size and is probably better than the smaller size as used.

Begin by making up full size drawings from the plans shown. Better



Aligning the bulkheads on the keel member with great precision will assure true contours in the finished model.



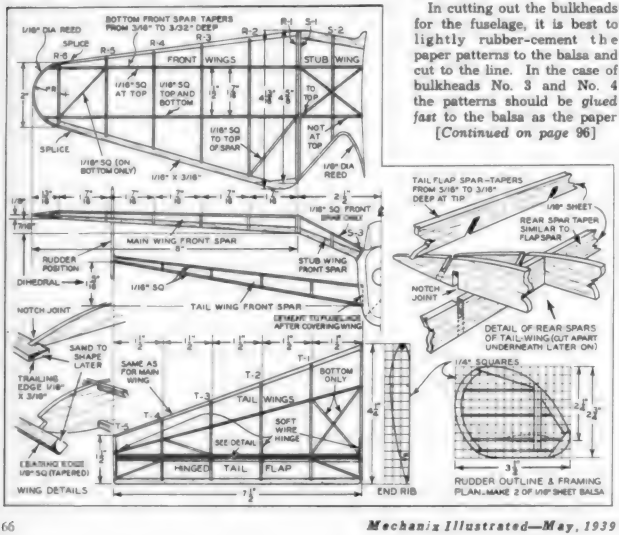
Incidence of the wings is zero, due to the high forward gull-wing, and low tail wing with dihedral angle. Cover the wings before cementing in place, and cement rudders to the fixed portion of the tail only, leaving the flap free for adjustment to flying trim.

still—if possible, have the plans given here photostated to full size, using the scale noted on the drawings to get the proper dimensions. Or you may have the plans blown up to any size you care to build the model. The great benefit of a photostat is that you get working size plans without the slightest effort on your part; that is, beyond the fifty cents or so the prints will cost you from the local engraver.

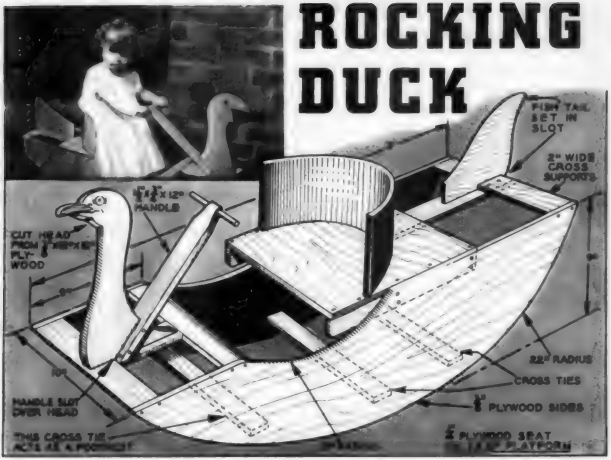
Having got your plans together start the actual construction by cutting out all the parts needed to build the model. This is tedious and generally uninteresting labor in all model building, but the wise builder always gets his parts out before starting even the smallest portion of the assembly. The parts required are clearly marked as patterns in the plans.

In cutting out the bulkheads for the fuselage, it is best to lightly rubber-cement the paper patterns to the balsa and cut to the line. In the case of bulkheads No. 3 and No. 4 the patterns should be *glued fast* to the balsa as the paper

[*Continued on page* 96]



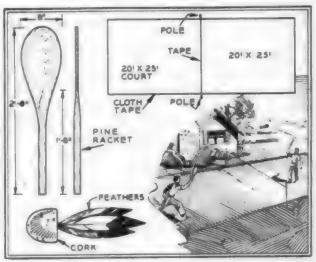
ROCKING DUCK



THIS sturdy, practical toy may be easily built from plywood and scraps. The drawing above gives all necessary instructions and dimensions for building it. Cut out the sides, head and tail with a coping saw. If the curved seat back presents any difficulty, a simple straight one may be substituted. To make a lasting job the duck should be screw fastened throughout. Finish by enameling in bright colors.—*C. Ibberson.*

SHUTTLE-COCK GAME

YOU can make the equipment for this lively lawn game in a short time, using strips of white cotton cloth, two boards, some feathers and a cork. Saw out the rackets from soft pine boards, planing down the blade of each racket to ¼" thickness and rounding the handle. Each racket is 32" long and 8" wide. The shuttle-cock is a large cork, one end rounded and the other fitted with several chicken feathers. Bind the feather quills together with cord, cover with glue and sink them snugly in the cork. The rackets can be painted a bright color, and the cork and feather tips dyed to match. The court area is 20′ by 50′, and is divided in two by bamboo poles set in the sod at the sides, and connected by a taut cotton tape 2" wide, placed five feet above

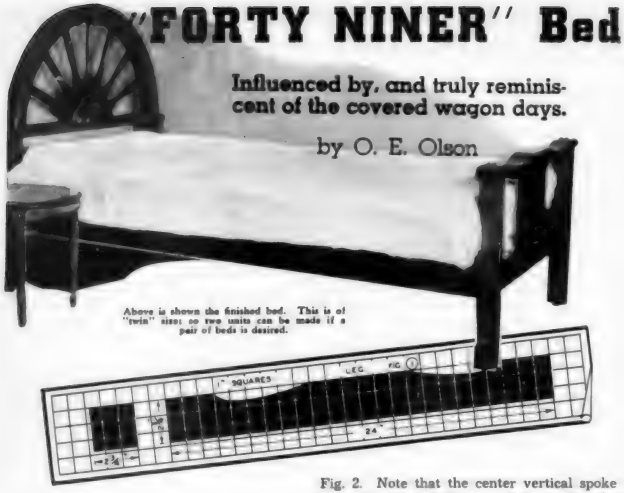


the ground. The four boundary lines of the court consist of cotton strips, torn from rags and stitched together. Peg the boundary strips to the sod. The game is played using Badminton rules.—*G. E. Van Horn.*

"FORTY NINER" Bed

Influenced by, and truly reminiscent of the covered wagon days.

by O. E. Olson



Above is shown the finished bed. This is of "twin" size; so two units can be made if a pair of beds is desired.

THIS bed is an echo of the historic gold rush period. The prairie schooner wheel, ox-yoke, and longhorned steer provide the factors of influence and contribute to a design both pleasing and practical.

Construction of the bed is comparatively simple. Black walnut, or any hardwood matched for grain and color can be used. The legs are cut from 2¾x2¾-inch stock, to dimensions shown in the graphed drawing, Fig. 1, above.

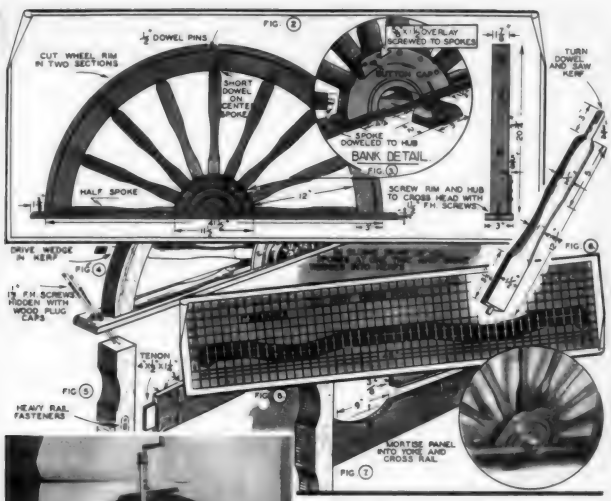
The wheel head assembly is the most difficult to make, but by carefully following the working drawings no difficulty should be encountered. Cut the wheel rim in two sections. Lay out, and cut a paper half-pattern to insure perfect duplication of both sections. These parts can be cut from a 2x9-inch plank. The union at the top is reinforced with two ½-inch dowel pins and can be additionally strengthened with a flat steel plate screwed to the back. Decorative groove cuts can be made on the rim face if desired.

The spokes are turned from 1½-inch stock, as shown in Fig. 6. Eight spokes are turned, one being sawed in half lengthwise, and each half screwed to the cross plate, as shown in Fig. 2. Note that the center vertical spoke has a short dowel, to prevent weakening the rim union. The hub unit is turned from 2-inch stock on the lathe, and the bank sawed out as shown in Fig. 3. If two beds are to be made (this one is of twin size) two units can be turned at one time. Then mark out and plane the flat spoke union surfaces on the hub. Bore the dowel holes in the hub so that the spokes will fit flush with the edge. Then bore the ¾-inch holes in the wheel-rim, giving particular care to the hole alignment.

With all parts made for the wheel unit, the hub, spokes, cross member and rim should be assembled at one time. Each dowel joint is glued and drawn into position with a clamp. The lower ends of the rim are screwed to the cross plate with 1½-inch screws from below. Glued wedges are driven into the spoke kerfs, as shown in Fig. 4, later to be sanded smooth with the rim surface.

The bank drawer compartment is routed out as shown in Fig. 3. A piece of felt can be glued to the bottom of the bank, to prevent any scratching on the cross plate. A narrow strip is fastened to the back of the hub as a drawer stop.

Screw the half-spokes and hub to the cross plate from below. The half-circle overlay



Above: Cabinetmaker's clamp holds spoke assembly in place while glue is setting.

shown in Fig. 3 is held to the spokes with hidden screws, each screw being recessed about ¼-inch and then covered with a wood button cap. The overlay will prevent any turning of the spokes and will add greatly to the appearance. It will also hide any defects of construction at the spoke and hub union.

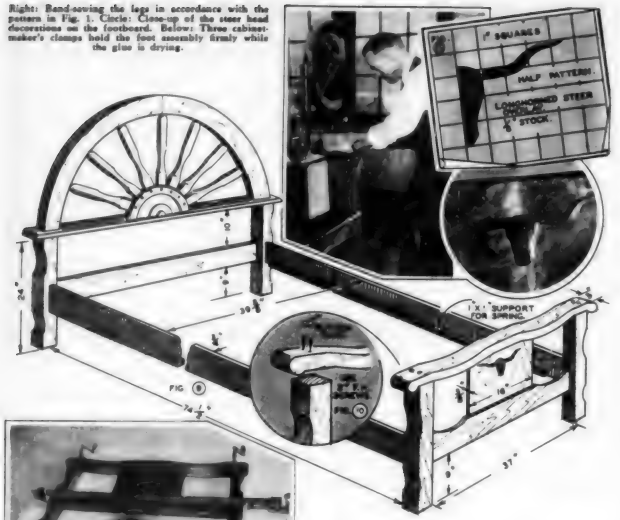
Next cut the head cross rail and fit to the legs with mortise and tenon joints as shown in Fig. 5. Glue cross rail and legs together before uniting with upper wheel assembly. Note that the wheel rim diameter is somewhat less than the distance between the outside of the legs, thus allowing room to drive the two 1½-inch screws through the cross plate and into the legs as shown in Figs. 4 and 5. These screws are recessed and hidden with wood plugs which should be sanded flush with the surface.

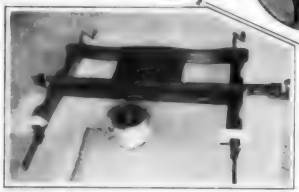
To make the foot assembly, lay out and cut a paper pattern of the yoke, or upper cross member, following the specifications of graphed drawing in Fig. 8. This piece is cut from 3x3-inch stock on the band saw and dressed to dimension with plane, spoke shave, and sandpaper.

The back panel is ⅜-inch thick, and can be made of ply-wood, or built up in width by gluing matched solid stock. This panel is mortised into the lower cross rail, and into under side of the yoke. Cut the end mortise and tenon joints of the cross rail, and glue up the complete assembly, as shown in the photograph. The yoke is fastened to the legs with hidden 2-inch screws as shown in Fig. 10.

The side rails are of ¾-inch stock, with a 1x1-inch hardwood strip screwed to the lower inside edge, to serve as a spring support. The rail-irons are screwed in place in the legs and side rails. There are many styles of rail irons on the market so be careful to select a substantial type.

Right: Band-sawing the legs in accordance with the pattern in Fig. 1. Circle: Close-up of the steer head decorations on the footboard. Below: Three cabinet-maker's clamps hold the foot assembly firmly while the glue is drying.





Make a pattern of the long-horned steer, following the drawings of Fig. 11, and trace on ⅛-inch hardwood stock. Then cut out and sand all top edges round. A pleasing contrast of color can be obtained by applying two coats of black India ink to the overlay before mounting on the panel. The mounting is done with two or three wire brads and glue. Sink the brads and fill holes.

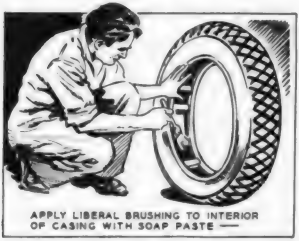
The selection of casters or gliders is very important, and there are many styles and models to choose from. The improved large gliders are very satisfactory and will not mar the floor. They also give a minimum of elevation to the bed when installed. Be sure to determine the size of the insert shank on the model chosen before boring the retaining holes.

Sand over all with number 00 sandpaper preparatory to finishing. If black walnut is used spot out the light sapwood portions with a penetrating walnut stain, to match the full color of the dark wood. Then apply a coat of raw linseed oil to bring out the grain. Let stand for twenty-four hours. Then rub off any surplus oil that did not soak in. Apply a coat of high grade varnish and let stand until thoroughly dry. Rub to a smooth finish with fine steel wool. Apply another coat of varnish and repeat the procedure of the first coat. Then apply the third coat, and let stand for forty-eight hours, after which, rub down with very fine pumice, or rotten stone in oil. On a close grained wood, this should produce a smooth, satiny finish.

If the construction is of open grained wood, a coat of wood filler is applied first, which, when set, is rubbed across the grain with a piece of burlap. If a color stain is desired it should be applied at this point. The balance of the finishing procedure is the same as described before. A finish of white shellac, in multiple coat, can be used, but of course will not be as durable as the varnish finish.

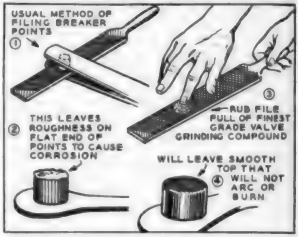
Easy Methods For Motorists

Soap Paste Prevents Chafing And Excess Heat In Tires



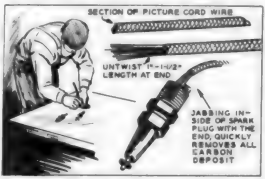
YOU can avoid a lot of chafing, and keep down excessive heat in your tire casings by mixing a stiff paste from soap chips or flakes, then applying it to the inside of the casing. Dissolve the soap in water, by means of gentle heat, until the mixture has the consistency of heavy paint. After it has cooled add a couple of teaspoonfuls of ammonia for each pint of paste. A little talc may also be added, although this is not strictly necessary. Coat the inside of each casing liberally, and allow the mixture to dry well before replacing tube and rim. The soap will form a lubricant between tire and tube, eliminating much of the friction from this source.—*A. H. Waychoff.*

Better Way To File Points



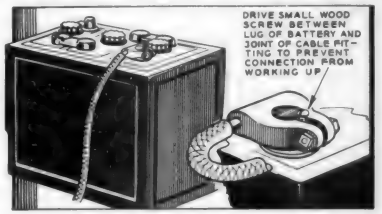
NO MATTER how fine the file or how carefully you use it on the ignition points, you are bound to leave them slightly wavy as shown at (2). These wavy lines, while practically microscopic, are rough enough to cause the points to start wearing immediately, soon becoming bumpy, pitted and making the filing job inefficient. This can be avoided by rubbing the file full of any good valve grinding compound before using (3). Apply the finest grade compound and rub it on with the finger so that all the grooves in the file are packed. This fills out the surface of the file so that it has exactly the right amount of abrasiveness to make it cut the points quickly and smoothly, leaving them flat and polished.—*A. H. Waychoff.*

Wire Sparkplug Cleaner

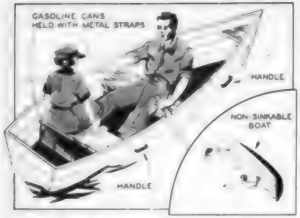


A SMALL scrap of ordinary flexible fine wire picture cord makes an excellent emergency sparkplug cleaner. Use a piece three or four inches long, unbraided an inch or so at one end, thus forming a stiff brush. Jab this about the inside of the shell, and around the porcelain insulator. In a few minutes the plug will be bright and clean.—*A. H. Waychoff.*

A Crawl Proof Battery Connection



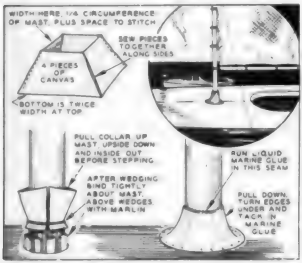
BATTERY terminals usually taper towards the top, and sometimes the lugs "crawl" up, loosening the connection and breaking efficient contact. To overcome this difficulty, tighten the cable lugs as usual, then drive in a small brass wood screw at the point where the split sides of the connection are drawn together by the bolt. This will keep a tight contact, and at the same time can be easily removed.—*A. H. Waychoff.*



Tanks Make Boat Unsinkable

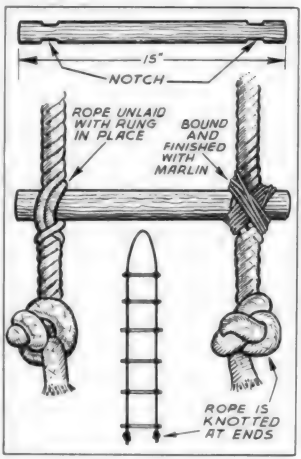
ALMOST any row boat can be made considerably safer by the installation of several empty tanks under the seats, and two metal handles on each side of the hull. In the event the boat is overturned, the tanks will prevent it from sinking, and the handles will serve as a place for persons to hold onto.

A Leak-Proof Mast Collar



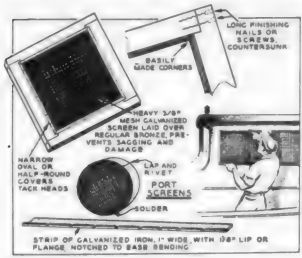
A LEAKING mast collar not only makes all wet below in a cabin sailboat but allows water to start rot in partners and wedges. This easily made tight collar will fit either a round or rectangular mast. Cut four pieces of canvas and make collar as shown to be pulled up the mast before stepping. When the wedges have been driven tight bind it with marlin, pull the bottom down, turn the edges under and tack to the deck over liquid marine glue. The secret of its tightness is the little trough formed at the top when the collar is turned down. Run glue in this all around; it will remain plastic enough to give and take with the expansion and contraction of the wood. When removing the mast, or to get at partners or wedges simply pull out the tacks in the deck and raise the bottom of the collar.—J. A. Emmett.

A Rope Swimming Ladder



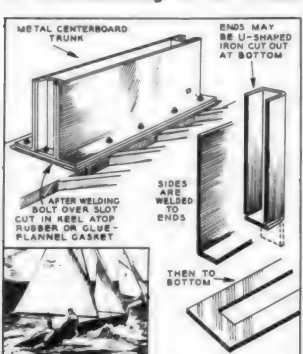
MOST boaters like to swim from their craft and a swimming ladder is a great convenience. Here is one that will cost next to nothing, and has no metal parts to bruise boat or swimmer. You will need a piece of ¾" manila rope somewhat more than twice as long in feet as the number of rungs you want in the ladder. The rungs will be spaced a foot apart so if you want a 6 rung ladder 15′ of rope will be required, the extra 3′ forming the loop at the top. Lay the rope down doubled and knot the ends separately. Now saw some old broom or mop handles into 15" lengths. Notch an inch from each end as shown. Unlay the rope above the knotted ends and slip the rung into place. Repeat this at 1′ intervals until all 6 rungs are in, or as many as you want. Bind each place, where rung enters rope with marlin, and your ladder is ready to lower overboard.—*Roland Cueva.*

Easy-To-Make Cabin Screens



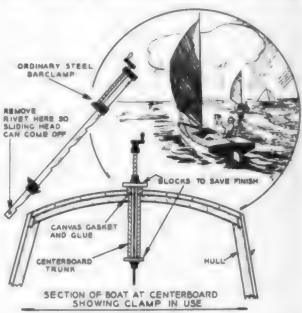
MAKING screens for all cabin openings is a worthwhile job for winter evenings. The corner shown is more simply made and stronger than the usual mitred style. If heavy 3/8" mesh galvanized screen is laid over the bronze, with tack heads and edges of both concealed by narrow half-round, the center will not sag and the heavy outer screen will prevent damage to the lighter bronze.

A Non-Leaking C. B. Trunk



ONE having access to a welding outfit can make a metal centerboard trunk for a small sailboat more easily than a wooden one. Base and sides should be of sheet iron 1/8" thick. Either flat bar iron or U-shaped stock may be used for the ends, the latter cut out at the bottom and bent over, as shown. Weld sides to ends first and then all to bottom. If the keelson is slightly curved, the bottom and sides must be shaped accordingly. The whole case is then set on a rubber or glue-soaked flannel gasket, and bolted over the slot cut in the keelson.—*J. A. Emmett.*

To Stop Centerboard Leaks

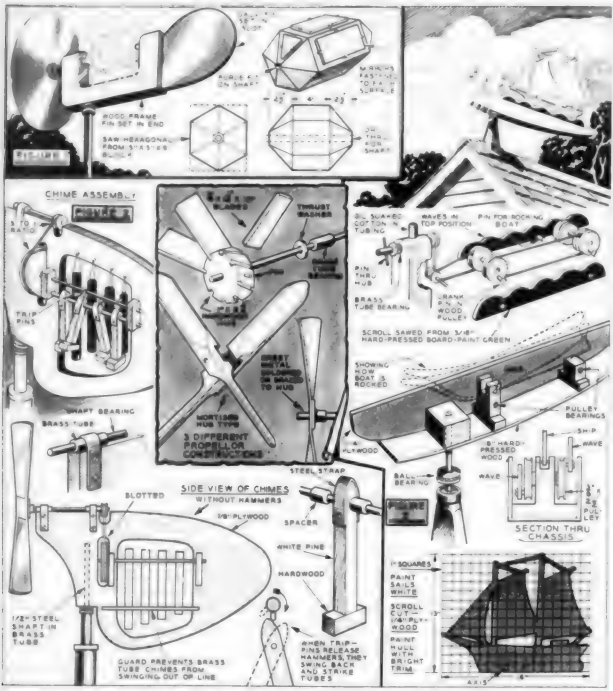


SECTION OF BOAT AT CENTERBOARD SHOWING CLAMP IN USE

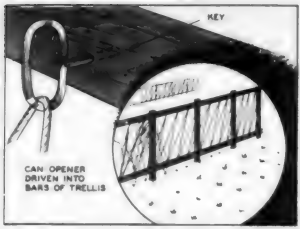
MANY a sailboat owner this winter will tear out his craft's centerboard trunk in an effort to prevent those annoying leaks that spoiled his last season's sailing. Here is a kink which will help do the job:

Remove the centerboard and trunk, taking the trunk completely apart. Paint the insides with Jeffrey's "C" quality marine glue and place heavy white canvas between the spacers. Cut a gasket of the same material for the bottom of the trunk where it joins the keel and set in marine glue. Now take an ordinary steel bar clamp and chip off the rivet that holds on the sliding end. This will not affect its usefulness, as the rivet simply keeps the end from getting lost. Lower the clamp down through the centerboard slot. Place blocks on the keel and centerboard to prevent denting the finish. Slip the end of the clamp back on as shown and tighten until the glue is forced out, then replace the screws in the keel up to the centerboard trunk, or about 4" each side of the clamp. Loosen the clamp and move toward the other end, replacing the screws as you go. —*Geo. E. Basich.*

NEW JOBS FOR THE "WINDMILL"

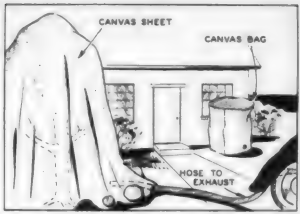


HERE are some new applications of an old principle; power from the wind. The schooner at the upper right plunges in a rolling sea, close-hauled to the wind. With scroll-saw and lathe one can easily make this novel weathervane. Pulleys assembled in pairs operate the waves in a rotating motion so that they appear to be moving with the wind, while the close-hauled ship plunges into the teeth of the gale. Wood pulleys are used throughout, and lengths of brass tubing make good bearings, with washers for spacers to prevent side play. A self-oiling arrangement is provided for the propeller shaft. At left, the whirling cylinder sparkles in the sun, and can be seen from a long distance. Three easy ways of making the propeller are shown in the center panel, and below is a novel chime arrangement which will strike a pleasant note in your garden. Various lengths of brass tubing are struck by wooden hammers which, in turn, are actuated by pins on a revolving shaft, assembled as shown. By experimenting one can get required tones.—*Hi Sibley.*



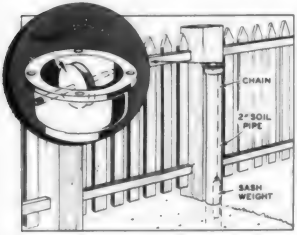
Can Opener Key For Trellis

A PEA trellis that won't have to be rebuilt the second season can be made by driving can opener keys into the wood instead of nails. The string is looped through the key, and cannot slip off or come loose during the rough winter weather.—*F. Dought.*



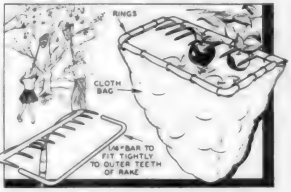
Exhaust Fumigates Shrubs

COVER the tree, plant or bush to be fumigated with a canvas sheet or bag weighted with rocks. Connect a hose to the exhaust and run it under the sheet or bag. Start the engine, and in a few minutes all the bugs will be killed.—*A. H. Waychoff.*



Sash Weight Closes Gate

INSTEAD of the usual spring which bangs the gate shut, try the gadget above. Sink a 5-foot length of 2-inch soil pipe in the ground even with the gate's top. Hang a sash weight by an ordinary link chain run over the pulley and fastened to the gate. If too heavy, knock pieces off the weight until the correct balance has been attained.—*J. B. Huntor.*

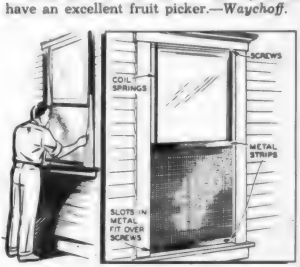


Rake Makes Fruit Picker

BEND a ¼-in. piece of pipe and fit it over the outer teeth in the rake. Hang a flour sack from the frame thus formed, and you will have an excellent fruit picker.—*Waychoff.*

Half-Screens For The House

A SIMPLE half-screen for sash windows that anyone can easily install is shown at right. It is instantly adjustable by inverting, to either upper or lower sash, and may be used inside or outside.—*D. L. Stoddard.*

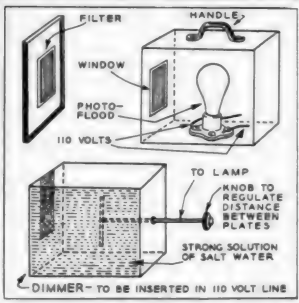


BLACK LIGHT MAGIC

By MAXWELL REID GRANT

Startling and beautiful experiments in fluorescence can be performed under ultraviolet ray with the aid of the simple equipment described here.

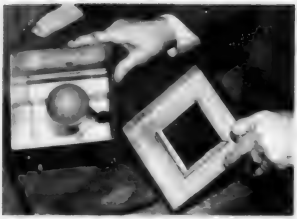
Masks or "skulls" coated with fluorescent paint glow weirdly when bathed in invisible light.



WITH a simple homemade "black light" lamp you can perform startling experiments with fluorescence, the queer phenomenon which police are using to detect forgeries, expose altered documents, reveal faint bloodstains, or trace currency secretly marked with invisible ink. Your generator is an ordinary photoflood bulb, placed in a box with a window covered by a filter to mask off the visible rays. The filter should be a Corning Glass Company's Red-Purple Ultra No. 587, designed to absorb visible light so it will not drown the glowing fluorescent effects. Ordinary colored glass will not do, as it absorbs most of the ultraviolet. A good filter will cost from sixty-five cents to five dollars, depending on the size; 3½-in. is a good size and may be bought for about two dollars. Black light can be put to practical use in many ways. Beans and many plant seeds fluoresce only if the skin is unbroken, making the sorting of imperfect ones quick and certain.

Marking laundry with fluorescent ink. Such marks show only under ultraviolet light, thus keeping the garment unmarred.

Some laundries now are using machines which stamp clothing with waterproof marking fluid visible only under ultraviolet light, avoiding ugly black stains on linens. By alternating white and ultraviolet light, pictures may be made to appear and disappear at will. Photography in a nearly darkened room is possible with judicious placement of the "black light" sources, and if your hobby



Common drab stones and minerals glow with a gorgeous display of color in front of the magic lamp.

Artificial flowers, their fluorescent-painted petals emanating soft radiance under the ultraviolet.

At left: Photoflood lamp in a box with correct filter is the simple source of "black light."

The same artificial flowers as those below, but photographed in ordinary white light.

is magic, you will find the possibilities of new illusions virtually endless.

In the dark, many rocks that appear drab in daylight show streaks of bright pink, orange, green, violet, or yellow under the invisible rays. Certain minerals that can scarcely be identified by the eye will appear outlined in glowing colors under ultraviolet light. Tungsten ore, amber, barite, some calcites, telurite, rhodamine, sphalerite, and willemite are among the most responsive. Gems also may be studied advantageously by fluorescence. Synthetic rubies invariably fluoresce a light color, while real rubies are a distinctive deep wine red. Pearls show colors which depend entirely upon the waters where they were cultivated, those from the same water always showing the same color.

Dissolve an aspirin tablet in water, and you have an ideal invisible ink, glowing under the ultraviolet lamp with a bright green brilliance. Vaseline, mineral oil, many kinds of glassware, certain fabrics and cosmetics, reveal weird beauty. Add a little quinine to the water in which flowers are kept and you not only keep them fresh for a long period, but also cause the water in the vase to fluoresce a dark blue. For this purpose the

[*Continued on page* 95]

THE application of hot liquid paraffin to doors and windows that bind is greatly facilitated by the device shown above.

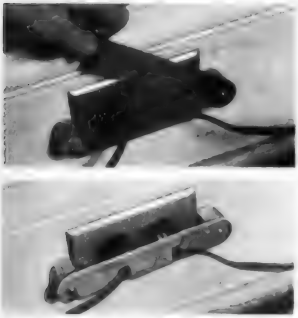
A frame holds a small alcohol lamp under the receptacle containing the paraffin. The flame is sufficient to keep the paraffin in a liquid state, thus speeding up the work.

The frame is a piece of hoop brass bent into a circular loop and riveted. To this, three brass legs, each bent to form a rest for the paraffin container, are attached.

Wire a piece of copper screen around the legs. This guards the flame and prevents the lamp from sliding off the platform, as it might do in the hands of a careless worker.

The handle is the end of a broom stick, cut at a slight angle and held in place by a screw through the brass loop.—*Bertram Brownold.*

Light Plug Guard



AN EFFICIENT guard which will prevent light plugs from being accidentally pulled out can easily be made from a brass bar (1"x⅛"), two pieces of broom stick, and a couple of screws. Notch the brass as shown to accommodate the wires, and fit over the retaining screws.—*Bertram Brownold.*

Waxed Cork For Glue Bottle

CORKS used in shellac or glue bottles usually stick in the neck of the bottle and are very hard to remove. This difficulty will be overcome by coating the cork liberally with paraffin. It is best to use a new cork for this.—*Howard R. Heydorf.*

Dry Cell Connector-Handle

WHEN dry batteries must be moved around, the illustrated form of connector is very helpful. The connectors are bent from heavy copper wire. It may be found desirable to fasten the bottoms of the batteries with a light strap.—*Howard R. Heydorf.*

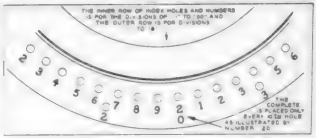
Door Stop

AN EXCELLENT scrap-material door stop can be made in a few minutes from a piece of spring metal about 2-in. x 9-in. screwed to two wooden blocks about 1 x 2 x 2-in. Cover the blocks with rubber from a discarded inner tube.—*Bertram Brownold.*

Developer Can Makes Good Double Boiler

THE new type developing powder cans make fine double boilers in which to melt glue, gelatin, etc. The small inner can holds the substance to be melted, while the outer part is half-filled with water. Punch several small holes in the rim of the outer can to allow the steam to escape.—*Louis Hochman.*

Indexing Lathe Holes

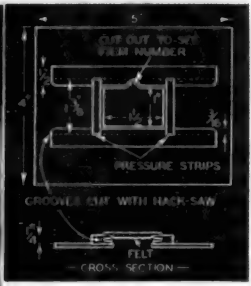


LATHE work may be easily indexed by numbering the holes. On most lathes the divisions are 60 and 8. The index head should be well cleaned, and the numbers applied with India ink or black paint. For a permanent job the numbers can be stamped into the metal with steel letters. Because of the lack of space the full numbers are applied only every tenth one. Drawing shows arrangement of numbers.—*Howard R. Heydorf.*

Fitting Chair To Job

A LOW wooden chair can be easily converted into a higher swivel workchair. Oak cross pieces are fastened to the legs and fitted with freely moving casters, thus raising the chair several inches.—*Walt Messenger.*

CARRIER FOR 35 MM FILM

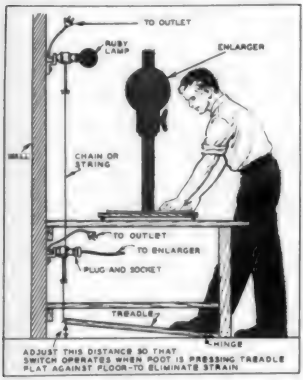


The 35mm film slides freely in the grooves of the home-made carrier, and is wiped free of dust by felt-lined pressure strips, which bridge the center portion of carrier.

A GLASSLESS 35mm film carrier that will fit in your enlarger and permit rapid change from picture to picture, can easily be made in a few minutes. It will fit the regular negative carrier, or you can build a new carrier around it, to fit the enlarger in place of the one provided.

In the center of a rectangle of heavy cardboard or light wood, the size of the negative carrier, cut a 1x1½-in. hole. Two wood strips ½-in. wide and ¼-in. thick, must have a lengthwise groove $\frac{1}{16}$-in. deep cut in their ¼-in. side with a hacksaw. These strips form the grooved slides for the film. Nail them to the wooden rectangle, parallel to each other, along each 1½-in. side of the hole, just wide enough apart to allow the film to slide freely

[*Continued on page 87*]



Improved Enlarger Control

THE serious amateur photographer soon learns that the best way to control his enlarger is by means of a switch operated with the foot, because this leaves both hands free for "dodging." At the same time, he finds it desirable to have a safe-light near the enlarger so that it is easy to change adjustments on the paper easel and to place and remove the paper properly. Furthermore, this safelight should be turned off when the enlarger is on, because it is easier to focus, frame, and judge the printing time in complete darkness.

What is necessary, therefore, is a single-pole, double-throw foot-switch, and it is possible to secure all of these advantages in a thoroughly practicable arrangement costing very little, with the additional feature of being able to control either the enlarger or the safelight independently.

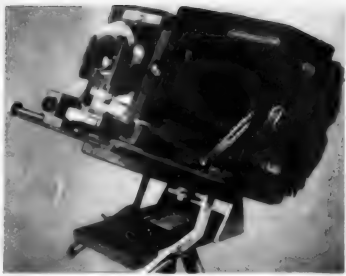
[*Continued on page 87*]

TRIPOD TILT-TOP

THIS sturdy, easily built tilt-top will take care of those numerous angle shots confronting every photographer. The drawings and photos make the construction clear. Make the side arms and front plates from ⅛-in. hard rolled sheet aluminum. This is stiff but easy to work. The side-arm pattern is full size.

If the top of your tripod is larger than 3½-in., widen the boards of the tilt-top to fit so there will be no obstruction to the side arms. Recess a square, ¼-in machine screw nut flush in the bottom board; screw on a square of thin sheet metal to hold it in place. Use a standard tripod clamp screw to hold the camera to the tilter; or a ¼-in. machine screw with a knurl or wing nut pinned to one end, and just long enough to extend $\frac{3}{16}$-in. above the surface of the top board. File off all the threads above the projecting $\frac{3}{16}$-in.

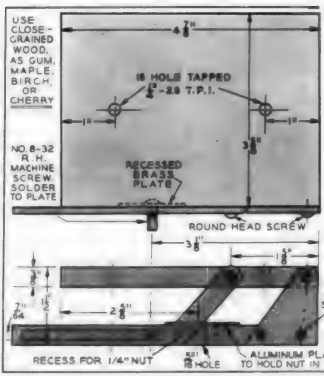
Stain the wooden parts and finish with clear lacquer or several coats of well rubbed boiled linseed oil. Fine sandpaper will give the metal parts a satin finish, making a professional looking tilt-top that you won't take $5.00 for!—*C. G. Grover.*



Tilt-top in use with a heavy 4 x 5 camera. A sheet of felt may be glued to the top to prevent marring of the camera bed.

Side arm removed to show construction. A 1 32-in. brass plate with a 6-32 R.H. machine screw soldered to it is set flush in the edge of the bottom board. A washer and wing nut clamp the aluminum side-arm to the plate.

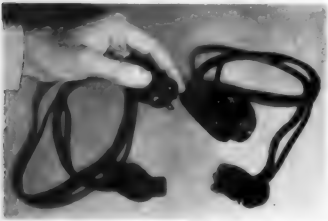
A square nut recessed in the bottom board is held in place by thin sheet aluminum. Note camera clamp screw with knob pinned to it and most of the threads filed off.



Kinks for Camera Fans

TRACING-CLOTH SCREENS FOR FLOOD LIGHTS soften harsh lighting. Solder or rivet a 6-in. strip of 1-in. brass or aluminum to a spring clip and bend one end to a right angle. Drill a hole and attach a frame to it as shown. Frame is plywood 1-in. wide and ½-in. thick, or its equivalent. Glue tracing cloth to the frame to complete the screen. Heavy wire for frame may also be used.

PRINTS DRIED RAPIDLY ON LAMP STAND. Strip lamp shade frame of its covering and use frame as shown below for rapid and effective drying and ferrotyping of prints. When placed on gas stove use smallest possible flame. When placed over a bulb, a 100-watt is sufficient. This method dries and ferrotypes prints in less than 10 minutes.



UNIVERSAL CONNECTOR LINK for taking flashlight pictures. It consists of two lengths of wire, one 110-volt plug, one 110-volt multiple plug connector and a separable plug to fit flash gun. Assemble as shown. This device enables use of lamp stands and wall sockets. Hook to current outlet and connect leads to multiple socket and connect other end of connector link to flash gun. Use open shutter-flash-close shutter exposure method.

RUBBER CRUTCH TIPS GUARDS TRIPOD POINTS. The three ends of the tripod may be securely held in place when carrying the tripod simply by slipping a crutch tip over their ends, as shown at right. This prevents injury to the person and facilitates carrying. It's a neat, practical, convenient and cheap way to solve the problem of carrying the tripod without causing damage.

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◆ No Sir! You can't eat wishes--you can't wear wishes--and wishes won't keep a roof over your head. You can't wish yourself even the ordinary things it takes to just live... and a fellow wants far more--a real job, good pay, a big future, marriage, a nice car, future security, success.

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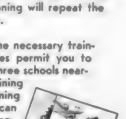

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LIGHT METERS DIFFER

Q. Why is it that different light meters do not record the intensity of light the same?—M. Greenleaf, New Haven, Conn.

A. It is unfair to compare light meter readings, as meters of different makes are calibrated differently and even meters of the same make do not always register the same. This fact is no reflection on the meters. Their different recordings can be compensated for by the photographer, who must take in consideration the characteristics of the film he is using and the quality of negative he desires. All meters are calibrated to give negative densities of "normal" quality. This density may vary according to different meters but the latitude of the emulsion on film is so great that perfectly satisfactory prints can be obtained from slightly under-or over-exposed negatives as well as from normal ones.

PRINTING PAPER CURLS

Q. Is there any way of preventing paper from curling so that it will lie flat on the easel during projection?—R. Novack, Great Neck, L. I.

A. There are several simple ways of keeping paper flat on the easel. Perhaps the best method is to rearrange the paper in the package by placing one sheet emulsion side up and the next emulsion side down, and so on with the entire package. When stored in this manner, the paper will flatten out in the package and remain flat during projection. Another method is to run the paper, emulsion side up, over a curved surface while holding it firmly by the edges. Care must be taken, however, that the arc of the curve is not too sharp, or the emulsion will crack.

PHOTOGRAPHIC TECHNIQUE

Q. Please answer the following questions: (1) Does a short-stop bath help make better pictures? (2) How many times can the M. Q. developer be used? (3) How do you use the one time developer? (4) I have a negative that is very dark and requires 30 seconds to print; what causes this?—Alex Mosden, St. Clairsville, Ohio.

A. (1) A short-stop bath is a valuable aid in the darkroom. It not only stops the chemical action of the developer on the print but it also helps preserve the quality of the fixing bath by removing the developer chemicals from the print before it is immersed in the hypo. Correct developing procedure is to yank the print from the developer at the exact point when development appears to be complete. Unless a short-stop bath is used, development will continue for a few seconds after the print has been removed from the bath due to the residue of chemical on the print. (2) M.Q. developer should not be used more than once. When in concentrated form, developer, either in powder or liquid, may be kept for a long period. But once the concentrated developer has been diluted with water, its keeping-qualities are destroyed. For best results, use a fresh M. Q. bath each time you print a batch of pictures. (3) Every camera is provided with some means for making a time exposure. Unless you refer to your camera by make, specific information cannot be given. However, the common method for making time exposures is to set the shutter indicator on "T" or "B". This means "time" and "bulb." If the shutter speed indicator is set at "T" it means that the shutter will open when the shutter release is depressed and that it will remain open until the shutter release is again depressed. If the indicator is set at "B" it means that the shutter will open and remain open when the shutter release is depressed and held down. The moment the finger is removed, the shutter will close automatically. Some simple box cameras are provided with a metal slide which is pulled out whenever a time exposure is wanted. In such cases the shutter sets for "T" only and the shutter release must be depressed twice—once to open the shutter and once to close it. (4) A negative that is dark is probably over-exposed. Under such conditions it requires an exceptionally long time for the light to penetrate it during printing in the darkroom. This condition must be corrected when the film is exposed in the camera either by increasing the speed of the shutter or by using a smaller stop opening or by a combination of both methods.

DOUBLE EXPOSURES

Q. How are double exposures made? What is the best method for cleaning a lens?—Nick Meyo, Cleveland, Ohio.

A. Double exposures are made while the film is in the camera simply by exposing the same film twice. When it occurs accidentally, it is a result of failure on the part of the photographer to wind the film immediately after taking a picture. Sometimes double exposures are made purposely for certain effects. In such instances, the first exposure is made of one subject and then the same film is again exposed for another subject before the position of the film is changed. As to a good method of cleaning the lens, special tissue paper is recommended. Such paper is simply referred to as "lens paper" in photographic stores. It is soft and the least likely to scratch the lens. Special fluids are also sold for cleaning lenses. However, they should be used only occasionally. It is a good idea to "dust" the lens with lens paper frequently.

LENGTH OF EXPOSURE ON PAPER

Q. What length of exposure should be made when printing pictures?—G. Mainard, Charleston, N. C.

A. The exact length of exposure when printing pictures depends on the density of the negative. As the density of the negative varies, so must the exposure time vary when printing the picture, unless, of course, the negative density is compensated for by increasing or decreasing the intensity of the light in the lamp housing or by changing the aperture of the lens diaphragm. (That is, by changing the size of the hole in the metal screen behind the front lens.)

IMPORTANT CONTEST NOTICE

The MECHANIX ILLUSTRATED monthly photo contest is being discontinued, beginning with this issue. HOWEVER, the editors are now conducting a bigger and better contest in GOOD PHOTOGRAPHY No. 2, a companion publication to this magazine. A total of $500.00 is being awarded in this new contest and every amateur has a chance to win one of the 84 prizes. Purchase a copy of GOOD PHOTOGRAPHY No. 2, now on sale at all newsstands or from our Greenwich, Conn., office, for complete rules of this contest.

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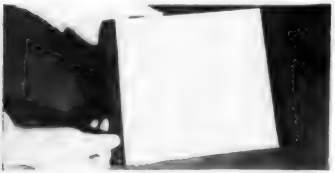
Ground Glass Focusing Aid

FIT a piece of thin wood holding a ½-in. diameter magnifying glass snugly in the focusing hood. The glass gives a larger and brighter image, while the wood prevents flaps from closing.—*R. Wick.*

Neat Bottle Labels

PROCESSING solutions may be catalogued with the identification clipped from the formula sheets accompanying film and paper. Cover it with a strip of transparent Scotch tape, or with a piece of cellophane which has been coated with rubber cement.—*Kenneth Murray.*



Non-Skid Paper Holder

A SMALL easel when used for enlarging is usually shifted about on a larger one until the right portion of the negative is included in the picture. Sometimes the small easel is knocked slightly and shifted out of position. Two strips of sponge rubber tacked at opposite ends of the underside will cause the easel to grip tightly.—*Everett Rudloff.*

Kitchen Device Removes Lens

THE kitchen tool for removing stubborn screw caps from fruit jars, etc., can be used to take lenses from shutters when they have become so jammed up in the threaded barrels that removal otherwise is often impossible. Pliers are dangerous to use for this purpose, because they cut up the metal lens mounts, and are liable to slip and scratch the lens surface.—*Herbert E. Hayden.*

Tin Funnel Becomes Reflector

IF THE delivery spout is carefully sawed off the end of a tin funnel and soldered to the outside housing of a standard metal light socket, the whole assembly can be mounted on a weighted base and used for a "back light" when making photographs.—*Herbert Hayden.*

Improved Enlarger Control

[*Continued from page 89*]

The trick is turned by using a pair of ordinary pull-chain electric sockets. The enlarger table should preferably be alongside a wall, or failing that, a wooden upright can be fastened to one end of the table. One socket is mounted six or seven feet above the floor, the other slightly below the table top. The sockets should be turned so that the chains hang freely straight down. Both chains are then fastened to a long piece of string or chain reaching to the floor. A treadle is made from a piece of wood $\frac{3}{4}$-in. thick, 15 or 20-in. long, and 3 or 4-in. wide. One end is hinged and screwed to the floor. The treadle should be placed parallel to the front edge of the table and within easy reach of the foot when standing in the accustomed place before the enlarger. The free end of the treadle is fastened to the end of the string, and, as shown in the illustration, the distance of motion should be adjusted so that the switches operate when the treadle is pressed flat against the floor.

Now a ruby lamp or other safe-light is placed in the upper socket, while a receptacle is screwed into the lower socket to take the enlarger plug. Wires from each socket long enough to reach the dark-room outlets should be installed beforehand.

The principle of operation should now be clear. One chain (say the safe-light chain) is pulled individually to turn on the light. The chain belonging to the enlarger socket is left in the off position. Then when the treadle is depressed, the safe-light will go off and the enlarger will go on. When pressed again, the reverse will occur. Thus we have a perfect switching system which performs all of the desired functions. In addition, either the safe-light or the enlarger may be turned on or off separately by pulling the individual chains.

Carrier For 35 MM Film

[*Continued from page 80*]

and smoothly in the grooves. Glue two felt lined pressure strips of cardboard or wood, across the slides on each side of the hole (as shown in diagram), to keep the film flat. They also serve the valuable purpose of wiping the film free of dust as it passes through, thus insuring a clear, spot-free enlargement.

The outside dimensions, 4x5-in., given in the diagram, are for the negative carrier of the Sun-ray Film Master enlarger which has slits in its sides to accommodate strip film. These slits should be lined with felt to protect the film.

For other popular enlargers, similar slits can be cut in the negative carrier on each outer side to provide an inlet and outlet for the film. For jaw type enlargers, a wooden frame can be built around the 35mm carrier to adapt it to the open jaw under the lamp unit.

TRICOR f3.5 LENS

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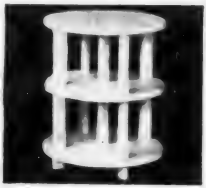
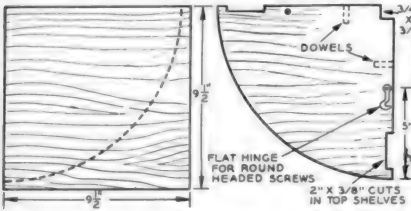
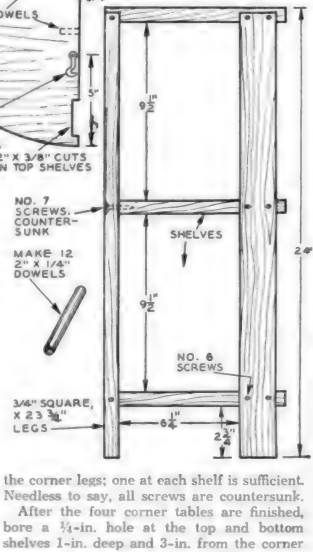
HOW TO BUILD A QUADRU-TABLE

Fasten these tables together with flat hooks and small round head screws. Have all hooks and eyes equidistant from the center, and on relatively the same side of each table.



Some of the many combinations in which these tables may be used are shown in the photos. Drawings below give construction details. Either lacquer or stained natural wood waxed and polished, makes a handsome finish.





THIS table is actually four identical little corner tables; and it has as many different uses as there are combinations of cards in a poker hand.

Begin construction by cutting twelve 10-in. segments from a 10-in. wide board. *These must be perfectly square.* If you intend to give the table a natural finish, take the four pieces in which the grain matches best for the top shelves.

Set a compass for 9½-in., and mark each segment of the four little tables. These will best be cut by a band-saw, but a jig-saw, or even hand operated coping-saw will suffice.

The middle and bottom shelf segments are all mortised the same, but the top shelf segments are only mortised for the legs to within ¼-in. of the table surface. All the legs are the same length, and should all be cut at the same time before assembly to be sure they are equal. It is also a wise plan to mark all shelf intersections together. Fasten the outside legs with Number 6 screws, two to an intersection. Use Number 7's for the corner legs; one at each shelf is sufficient. Needless to say, all screws are countersunk.

After the four corner tables are finished, bore a ¼-in. hole at the top and bottom shelves 1-in. deep and 3-in. from the corner

[*Continued on page* 113]

Device Raps Pilot To Warn Of Retracted Landing Gear

A warning signal that automatically thumps the pilot if the plane's landing gear is not in landing position when the engine is throttled down preparatory to landing has been patented by Clinton W. Howard of Washington, D. C., and Harold L. Carpenter of Dayton, Ohio.

Covered by a patent granted with the proviso that the United States government is entitled to its use without payment of royalty, the invention is designed to prevent landings with retracted gear. Although such landings are in most cases executed safely, they still damage the belly of the airplane in most cases.

The invention was made with the requirements of modern high speed military aircraft in mind. In them the maze of instruments and the roar of the engines are such that the pilot's customary alertness is somewhat dulled on occasion to aural and visual signals, with the result that he sometimes attempts to land with landing gear up.

The warning device consists of an auxiliary tread attached to the rudder and brake pedals. When the landing gear is in landing position, an electrical circuit is broken. It is likewise open when the throttle is in such a position that the engines are delivering sufficient power to keep the plane in full flight. But if the wheels are up in "flight position" and the throttle is not opened wide enough, the electrical circuit is closed. This sets into operation a small solenoid motor that literally raps the soles of the pilot's feet.

Robot Pilot Lessens Amount Of Airplane's Pitching

The automatic pilot, which makes use of a gyroscope in its airplane-guiding mechanism, increases the longitudinal stability and decreases the pitching of an airplane, Prof. Alexander Klemin, Perry A. Popper and Howard A. Wittner of New York University reported to the National Advisory Committee for Aeronautics recently.

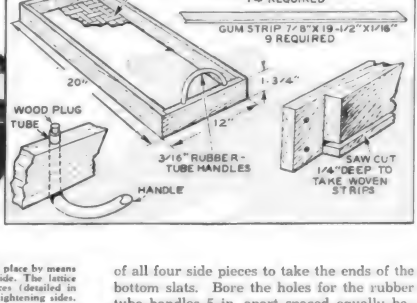
By increasing a plane's longitudinal stability, the automatic pilot makes possible wider variations from conventional plane design, since the designer need have less worry regarding longitudinal static stability or damping, they declare.

The decreased amount of pitch produced by the automatic pilot, in use on commercial planes, for example, primarily to relieve the pilots of one of their all-too-many tasks, corresponds to the stabilizing effect gyroscopes have on the roll of steamers in which they are installed.

Lattice Serving Tray

Closeup showing how bottom strips of different colored wood are woven.

The bottom pieces are thin and flat, providing a sufficiently smooth surface for glasses and bottles.



Rubber tube handles are held firmly in place by means of a wedge plug through the underside. The lattice bottom fits into slots in the side pieces (detailed in drawing), and is held in position by tightening sides.

THE novelty, low cost and good looks of this serving tray make it an ideal home project. Rubber tube handles and the lattice bottom, made from a handful of thin wooden strips of contrasty color, gives it an unusual touch. Here is a list of the materials you will need:

2 pieces figured or red gum, 1/2x2x20-in.
2 pieces figured or red gum, 1/2x2x12-in.
14 pieces white pine, 7/8-in. wide, 1/16-in. thick, 11-1/2-in. long.
9 pieces redwood or gum, 7/8-in. wide, 1/16-in. thick, 19-1/2 in. long.
2 pieces red rubber tubing, 3/16 or 1/4-in. dia., 12-in. long.
8 nickled, round head screws, 1-in. long. Clear lacquer.

Cut and sand the side pieces. Make a saw cut 1/4-in. deep 1/16-in. from the bottom of all four side pieces to take the ends of the bottom slats. Bore the holes for the rubber tube handles 5-in. apart spaced equally between the end pieces. Cut and sand the bottom strips. Starting with one piece, weave them together, running the white pine strips crossways and the red strips lengthwise. Allow the ends to project 1/4-in. all the way around. Fit these ends into the saw cuts of the side pieces, then turn the screws home. (Be sure to bore holes for the screws). The handles are very easily locked in place. Simply insert the ends through the holes until they project about 1/16-in. Whittle out four wooden plugs and tap them lightly home into these ends. This will effectively prevent the handles from working out, and permits the tray to set level. Finally, give the tray a coat of good, clear lacquer.—*Dale R. Van Horn.*

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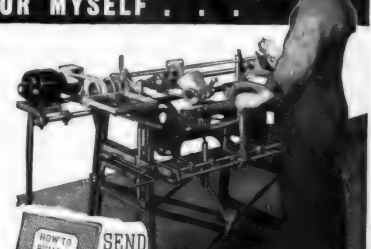

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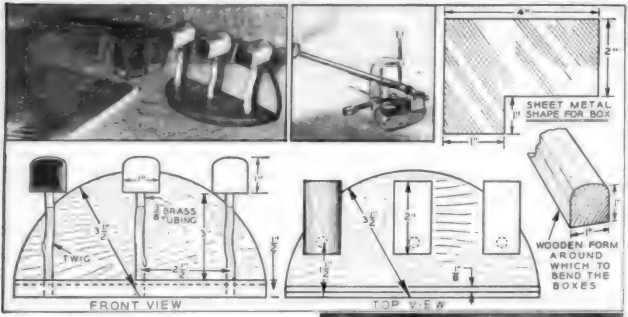

Mail boxes are made of sheet metal (galvanized looks the most realistic) mounted on natural twigs and held in place by brass sleeves. Letters are filed between boxes and backboard of stand. Drawing shows all construction details.

by Burl Knutson

Three most frequently used denominations of stamps may be conveniently kept in this handy letter rack.

THIS picturesque letter rack is also a very practical article. The mail boxes in themselves are symbolic of the purpose for which it is to be used, and make handy little containers for stamps; for instance, 3c stamps may be put in one, and 1½c and 1c stamps in the other two. They are large enough so a finger can be easily inserted to remove the stamps.

Obtain a piece of walnut for the base and a contrasting wood such as maple, for the back. The construction of these two pieces is simple, both being made in the shape of half a circle. The base has three holes, ⅜-in. diameter, drilled 2½-in. apart for the posts and a ⅛-in. mortise cut on the straight side to receive the back.

To make the article as realistic as possible, the posts, which are to hold the mail boxes, are cut from a small twig. This construction may cause the boxes to be tilted or tipped one way or the other, which doesn't make much difference anyway, since country mail boxes are seldom setting on an even keel.

The hardest job is to make the boxes, but this will not prove difficult if a little wooden form is first made, about which they can be bent and soldered. Cut a piece of thin galvanized sheet iron to the shape shown in the drawing. Bend the metal around the form and use "C" clamps to hold it together while you solder the edges. At the same time, while it is still on the form, solder a ½-in. piece of ⅜-in. brass tubing to the bottom about ¼-in. from the back. This will fit onto the post and hold the box firmly to it. File all the surplus solder and protruding metal from them after you are through soldering.

When finished give the whole article a coat of clear lacquer or other transparent finish and attach a piece of felt to the bottom. Small envelopes may be put between the boxes and large ones between all of them and the back.

NOW THAT the warm weather is on the way, how about building a boat for those spring and summer week-ends? Send for 1939 MI BLUEPRINT CATALOGUE, describing over thirty tried and true craft for which we can supply large scale plans.

Modern Miracle: Plastics

[*Continued from page 47*]

manufacturers. After the good products are separated from the bad, each one has to be trimmed, polished, and finished.

A sensational and comparatively new way of shaping cellulose-acetate and other plastics is the so-called injection molding. If you've ever thrown a snowball full force against a stone wall and seen it flatten out and stick in place, you can appreciate the beauty of this system. Instead of putting powdered or pellet-formed plastic matter directly into a mold, it is fed into a different type of steel cylinder which is hot enough to soften the plastic. Then, with a force of perhaps 26,000 pounds per square inch, a piston squeezes the plastic out through a nozzle and smack into an already cool mold, and the material fills the mold neatly and hardens rapidly. Modern apparatus has a top capacity of more than a pound per push. Automobile steering wheels can be turned out at a rate of 60 an hour; small knobs for your dashboard or your radio are sometimes produced in 20 seconds; thousands of combs, toy pistols, and other gadgets are squirted through injection-process nozzles.

A single nozzle-forced lump can be pushed into its mold so hard that it will spread out to cover an area of as much as 90 square inches. Moreover, multi-nozzled injection units are being made which shove several gobs of plastic into molds simultaneously and can therefore be used to produce extremely sizeable objects on a large scale. In this connection, Howard W. MacMillin of the Hydraulic Press Manufacturing Co., stated:

"In the metal working industries press capacities of 1,000 to 2,000 tons are not uncommon, and presses of the modern self-contained type have been constructed up to 5,000 tons. It can be conceived that using a clamp of 5,000 tons and a number of injection nozzles, it should be possible to mold a bathtub, for example, at a single shot!"

Injection molding has considerably boosted the stock of the cellulose-acetates. One reason for this happy wedding of a material and a method is that these substances are "thermoplastic"—that is, after they harden, they can be softened again by the application of heat. Some other plastics, however, are "thermosetting" and harden into unmeltable masses. This is important in connection with the injection process because using this method results in a lot of overflow scrap, and only the debris of thermoplastic plastics such as cellulose-acetate varieties can be re-heated, re-softened, an re-used.

Cellulose-acetates are well up in front among the world's leading plastics. But Bakelite and many other plastics have also cut their niche on the market.

The development of Bakelite will be discussed in the third article of this series next month. The story of how new plastics resulted from the search for color plastics will also be told.

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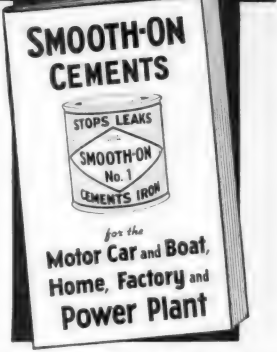

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Boring Tools For Your Woodworking Lathe

THE illustrated jigs provide a means of boring accurate holes in wood turnings when the lathe is not equipped with a metal turning rest. The tool at left has a turned wooden shank which fits into the taper of the tailstock sleeve. A cutter is shaped from tool steel and fastened to the shank so that it may be adjusted sideways to the desired size hole. The jig above is similar except that it clamps around the tailstock sleeve and is used for the larger size holes. The cutter is held in a slot as shown. The hole to be bored is first roughed out and the tool is fed into the bore by advancing the tailstock sleeve.

Thumbscrew For Headstock Oil Test Screw

THE oil test screw in some makes of lathe headstocks may be quickly changed to a thumbscrew by soldering a half washer into the screw slot as shown. This permits the amount of oil to be easily determined.

Black Light Magic

[Continued from page 77]

black light generator may be replaced by a single two-watt argon blow bulb, costing fifty cents. Concealed behind the flowers, it will keep them illuminated continuously at a cost of less than a cent per hundred hours. It makes a striking ornament for a dark hall corner.

Many paints and practically all aniline dyes have fluorescent properties—which, however, can be determined only by actual trial. Tested fluorescent paints may be bought in kits of assorted colors. In larger quantities, fluorescent lacquers, varnishes, and dyes also are available. By ingenious application of these materials, combined if desired with fluorescent cosmetics, spectacular effects are possible. Special face powders enable you to appear white under ultra-violet, or black under red light—a startling transformation accomplished instantly by the quick flick of a switch. For Halloween parties, a chamber of horrors can easily be produced, with skeletons and grinning skulls touched up with fluorsecent paint, leering hideously when the lights go out. Wire a dimmer into the circuit to permit the "horrors" to materialize gradually. A wire-wound rheostat, or a pair of movable plates immersed in salt water, will serve the purpose admirably.

An oil painting or a dime store picture may be touched up to undergo surprising changes when white light is replaced by ultraviolet. Cut out the picture, mount it on cardboard or wood; place behind it a sky scene done with fluorescent paints; between the two place your black light generator and you have a night scene silhouetted against a beautiful sunset or moonlit sky. When possible, so arrange the subject matter that the lighter colors are farthest from the light, the dark ones nearest. For example, in a day scene with bright sky and dark foreground, put the lamps at the bottom; but in a night scene, with dark sky and the stars coming through and with lighter foliage in the foreground, place the lights at the top. A part to be accentuated will benefit by having the lamp close to it. In general, backgrounds should be good reflectors of white light, such as pure white lacquer or very bright sprayed aluminum.

It has been figured that there is one chance in 20 million years of a comet striking the earth.

Glass tape is being tried as insulation material for motors.

The discovery that steel and iron can be rolled while cold, as well as while hot, was made by an accident and keen observation, about 80 years ago.

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Build And Fly Cannon-plane

[Continued from page 66]

will serve to strengthen these important members.

The fuselage is built around a central keel which not only serves to stiffen the structure but also is valuable to check the alignment. The bulkheads are set into this keel piece and only cemented after the most careful and exact alignment. In fact, the entire alignment of your model depends upon this detail, so watch it carefully and get real results. Note that bulkheads No. 3 and No. 4 also carry the stub wing spars. By cutting and fitting these two members accurately you will save much trouble later when it comes to aligning those ticklish gull-wings. The model as built utilizes sheet balsa for the entire fuselage covering. This has many advantages—notably the fine slick finish obtainable to say nothing of the tremendous strength inherent to this form of structure. However if you desire to "add more lightness" and have greater flyability, the balsa covering can be dispensed with and a few longitudinal stringers set into the bulkheads, to be later covered with paper.

After lining up the bulkheads on the keel the next step is to fit the landing legs. The landing struts are built up of three layers of 1/32" sheet balsa with a length of .028 piano wire sandwiched between. The whole is cemented to bulkheads No. 3 and No. 4 and to the keel. This assembly results in exceptional strength at a point where strength is needed, and adds but little to the entire weight. Fair the landing gear carefully before cementing to the keel.

Now take the ribs for the center-section or front wing stubs and fit them carefully in place. The inner ribs, the root ribs, will be placed at an angle which approximately conforms to the fuselage line. The center and outer ribs will be vertical. Fit the ribs but don't cement them in place *except* the inner or root rib. This rib, each side, should be glued fast now. A single center stringer is let into the tops of the bulkheads from No. 1 to No. 5.

With the root ribs in place the fuselage covering may be started. Work from bulkhead No. 1 to No. 5 *above* the stub wing first. A paper pattern may be required here to ensure a snug fit but in any case fit this piece carefully and slightly dampen the sheet balsa before trying to lay it. With this first piece of sheet balsa laid the model will look exactly as shown in the construction photo accompanying.

The entire fuselage covering is of 1/32" sheet balsa which is later sanded down to about 1/64" for lightness and also to obtain uniformity of contour. It is quite easy to apply this sheet covering as long as it is put on wet and is fitted carefully. Wherever joints occur the sheets should be beveled to a close fit for an even seam. The order of covering is roughly as follows: The top forward section as already mentioned; then from the nose to the landing legs on the belly; from this point backwards, still on the belly, to

bulkhead No. 6 and so on to the last bulkhead. The sides may be closed, using paper patterns to ensure accurate fitting.

The portion between bulkheads No. 5 and No. 6, aft of the fore wing root is closed in with stiff paper properly cut out for the windshield opening as shown.

Carve the nose and tail blocks and cement firmly in place after fitting the propeller hanger and the rear motor hook. Now complete the stub wings, fitting the ribs carefully to ensure perfect alignment. They may be covered now but it is better to wait until the wing panels are completed so that a further test for alignment may be made while there is still time to correct any possible errors.

The wings are made in the usual manner and present no particular difficulties. Fit the front wings first and then cement the tail wing in place using the front wings to sight for trueness all around. The tail flap is separated after covering and then only by cutting away the paper and surplus ribs as the bottom of the spars. The whole model should be doped two or three times —the fuselage first with clear dope and then with aluminum dope and the wings with clear dope only as they are covered with silver tissue. The rudders must not be glued to the tail flap portion of the wings or it will be impossible to operate the flaps later on when flying adjustments are needed.

Five strands of 1/16" flat rubber are used to power the model, and commercial wheels and propeller are recommended. Complete the pilots housing with thin bamboo and a very light grade of cellophane.

Flying Adjustments

The model should glide in normal manner and if your weights are so far incorrect as to require further balancing than the tail flap will provide, a small weight should be placed in the nose or tail as the case may be. The model shown came out exactly right, gliding and flying without more tuning up than a slight movement of the tail flap.

FEATURED NEXT MONTH

Spring and early summer are the star seasons for the garden hobbyist, but unfortunately, his mortal enemy the insect also thrives during this period. In the June MECHANIX ILLUSTRATED two interesting articles will take care of both sides of this ancient feud. Those wishing to improve their gardens this year can follow our suggestions and plans for attractive garden pools; for Mr. Bug's discomfort and demise we present the MI Fly Electrocutor—he won't like it a bit, but we're sure you'll want one or more of these around your home this summer.

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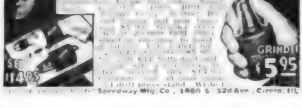

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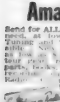

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Aircraft Radios "Torture" Test

[*Continued from page* 53]

facilitate the "torture" tests that soon prove whether or not a radio set "can take it."

For the first of these tests the "shake table" is used. The unit under test is clamped to a heavy metal table so floated on mounts at each of the four corners that it is free to vibrate. An eccentric placed on the lower side and driven through a variable friction drive by an electric motor shakes the whole assembly at frequencies between twenty-five and seventy-five cycles per second at an acceleration of ten times gravity, a vibration so intense that ordinary mobile radio sets break apart in a few minutes. To be acceptable, new equipment must withstand this gruelling ordeal for four hours without mechanical breakdown such as cracking of the metal or loosening of the parts, and it must operate perfectly at the end of the period.

If the set survives the "shake table," it goes into the humidity chamber, a big wooden cabinet in which the air is so wet and hot that the steaming jungle would seem like a summer resort by comparison. For 48 hours the atmosphere is maintained at 95% humidity and a temperature of 120 degrees Fahrenheit. The concentration of moisture together with the high temperature causes many fiber insulators to swell like paper, and it is here that electrolytic condensers and the covering of wires break down and puncture. Corrosion eats into bad electrical connections and unprotected metal parts. Throughout the 48 hours operating tests are made, and the unit must perform normally all the time.

At the end of the 48-hour period, a quick change is made from jungle steam to the icy blasts of a northern winter. Dry ice is piled into the wooden chamber until the thermometer toboggans to a reading of 40 degrees below zero. An almost microscopic bit of oil or grease between moving parts may fuse them as if they were welded. Exhaustive checks are made on crystals for activity, and chassis often warp and cause condensers to bind. Toggle switches and insulation suffer from the cold and condensation. As in the previous tests, the radio equipment must work perfectly at all times or be rejected.

Near the humidity chamber stands a cylindrical, iron tank with a clamp-encircled door. With its bulging end and round glass window, it resembles one of the much publicised "iron lungs" now in use in many hospitals. A radio is placed inside and vacuum pumps reduce the interior air pressure to the equivalent of 30,000 feet of altitude. At 30,000 feet airplane motors labor, and the air is too thin for pilots to live without oxygen equipment. The metal, wire, and insulators in a transmitter or receiver do not breath, nor do they have carburetor trouble, but altitude takes its toll in liquid leakage from oil filled condensers, erratic performance of oscillating circuits, and overall inefficiency.

Because every plane that goes up must come down, and because they sometimes come down in plowed fields or "pancake" in from a twenty-foot altitude, especially in emergencies, the radio must be able to operate after heavy shocks. The engineers' final attempt to break up the weaklings is to drop the unit under tests 18 inches onto one inch of sponge rubber. They do this not once, but *one hundred times*. Try this on your mantel set—provided you have no further use for it. Even under an inch of sponge rubber a concrete floor is mighty hard.

To paraphrase an old saying "many are tried, but few have the stuff to come through," but whether you are a pilot, a passenger on the airlines, or just an ordinary citizen with a healthy pride in American aviation, its a nice feeling to know that radio in the air holds its place of honor because, like any champion, it "can take it."

Inventor, Incorporated

[*Continued from page 37*]

Hogan tried to make an airplane out of a bicycle, and a machine gun from a shot gun. He didn't get very far with either.

Today, he may well be called a "suitcase" inventor because he carries his "shop" around in his traveling bag and pockets. Whenever he gets an idea, he goes to work on it immediately. He pieces his inventions together at home, on a train or wherever he happens to be. His only requirements are a pocket knife, piece of string and a few pins. He picks up practically everything he needs from local hardware or five and dime stores. He has no workbench or shop and all special lathe work is farmed out to a model maker. His balancing seal, for instance, was made from odds and ends. For the original model he used a rubber seal purchased from the five and dime store, a coffee can, rubber ball, a straw, a piece of wire and a small celluloid ball the size of a marble. The entire model cost less than 50c and was put together in several hours.

The seal was fastened to the top of the can and a tube was run from its mouth to the bottom of the can, where it was attached to the nipple of a balloon. A short tube was then attached to the rear end of the balloon and run to the outside of the can. A rubber bulb was attached to the mouth of this outlet. A piece of wire was shaped into a basket and attached to the mouth of the seal and the celluloid ball placed in the basket. In operation, the balloon in the can is blown up by pumping the rubber bulb. A valve prevents the air from escaping from the balloon except through the mouth of the seal. As the air escapes from that outlet, the celluloid ball floats freely in the air and looks as though the seal is balancing the ball from the tip of its nose.

One of Hogan's prize gadgets is a combination atomizer and nose dropper. It is composed of a rubber bulb with a glass tube in its neck. Inside

[*Continued on next page*]

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Inventor, Incorporated

[*Continued from page 99*]

this tube is another one of metal which permits the fluid to flow slowly when the gadget is used as a nose dropper. As an atomizer, it ejects a fine spray as the bulb is pumped. This simple gadget is scheduled for production this spring by the T. J. Holmes Company, New York, N. Y.

Hogan has also invented a "Boo-Hoo" baby doll that cries real tears. The doll can be made in any size, and emits a cry as small ducts in the eyes drop tears. The principle of it is very simple. The doll is fed a bottle through the mouth while lying down. As the water enters the mouth a trough carries it to a water pocket in the head. A valve is forced open by the pressure of the water passing into the trough and is closed tightly against its leaking out, also by the pressure of the water. When the rubber doll is squeezed, its emits a cry and a tear drops from a duct in its eye. The doll idea has been sold and is now in production by a New York City doll manufacturer. A feature of the doll is that it can be made of all-rubber—which is what manufacturers like.

Perhaps the best of his toy inventions is called "Topper's One-Man Show." Topper is a clown with a gyro inside. A rack is used to spin the gyro—which is set off center—and as it spins, the clown whirls about in fanciful gyrations and with a great deal of gusto. Topper is being manufactured, complete with a plywood stage containing a stool, a tight wire and a balancing pole, to perform on any and all of these props.

Hogan doesn't know where his ideas come from. He tries to think up something people need or figure out an improvement on some current gadget on the market. His procedure is to think up an idea, work out its details, and if satisfactory, make a patent application. His next problem is to interest a manufacturer and if he succeeds, his contract usually calls for royalties of about 5 per cent.

Selling the invention is probably the toughest job. Hogan believes that the major requirement for an inventor is a sturdy pair of legs and a good pair of walking shoes. There's a technique to selling an invention and the main trick is in knowing where to go. Some manufacturers only handle rubber novelties. Some handle a combination of rubber and plastic. Others handle only metal gadgets while others are equipped to handle only one-piece things; some only make wooden items; others only mechanical items. The inventor who knows his market can save himself a lot of trouble and heart-aches. He can also save the manufacturer considerable trouble and make him more receptive of the invention if the inventor will keep in mind such problems as cost of materials, tooling or casting, handling and distribution. Manufacturers prefer items that can be made easily and cheaply. Available materials, few moving parts requiring simple production machinery, easy handling and low price are standards by which manufacturers judge an invention's value.

Our Air Force—A Farce!

[*Continued from page 57*]

The Army needs the planes assigned to it—so does the Navy. Neither outfit dares to move without information from its "eyes." Neither can afford to waste ammunition without firing directions from its elevated fire control stations on wings. The sensible solution is to give the fleet and the army a thousand planes apiece, let them use them as they see fit.

We have enough air services. What we need is a great air force enabled to handle all air defense affairs, to work out the promising and dreadful future of air power, and give us the only kind of defense there appears to be against massed air attack. The Army and Navy do not offer us such protection in their service operations, and neither one's air service is strong enough to ward off the determined attack of a real foreign air power.

For all the expense of aviation and the losses which come with new types, it is a comparatively cheap operation. For the cost of one battleship, it is possible to buy about 500 gigantic bombers such as the Boeing Company calls "Flying Fortresses."

These bombers carry two 1,000-pound bombs. Five hundred times 2,000 is one million pounds of trouble that can be sent where they will do the most damage and far beyond where any fleet or army can think of going.

While it is true that the battleship will last upwards of 20 years, the fact that it preserves well does not increase its effectiveness in modern warfare. It is not protection or defense against an air raid.

The navy sees aviation's duty as an arm of the Fleet, and has divided its operations into four general groups; tender-based patrol bombing planes, seaplanes operating from battleships and cruisers, landplanes operating from aircraft carriers, and the aviation detachment of the Fleet Marine Corps forces.

None of these departments is set up to project a true air war, nor to thwart a determined attack. The long range patrol bomber has been the outstanding development in Naval operation during the past few years, and the routine transfer of whole squadrons from California to Hawaii and to the Canal Zone has emphasized the key part these big flying boats are playing in the Navy's long-range tactical program.

But flying boats suffer by comparison to land planes, and it is noteworthy that the air power nations are concentrating on the latter type. It costs much horsepower to lug the bulky hull of a flying boat through the air, and this cuts sharply into the bomb load which can be carried. For all their size and horsepower, our patrol bombers—even the new four-engined flying battleships—can accommodate only a negligible bomb load for long-range work. Negligible, I say, as compared to the load the landplane counterpart could haul.

The attempt of any navy to operate air power is awkward from the start. In tieing the operation to

[*Continued on next page*]

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Our Air Force—A Farce!

[Continued from page 101]

the sea to justify its existence, the navy handicaps aviation by take-off and landing limitations, by the wind-resisting hulls of the flying boats, and by elaborate—and vulnerable—shore bases and seagoing tenders with their broods of planes.

It is becoming recognized—even by many who do not fully subscribe to the potentialities of air power—that shore-based aircraft (landplanes) are superior in bomb-carrying capacity, range, and speed, to ship-based warplanes and flying boats.

If the national defense system of the United States were recognized to provide the true American air power which our production facilities and engineering skill can produce, we could have the whip hand in the Pacific with air power operating from Alaska.

That would about duplicate the trump card Russia owns in her gigantic air base at Vladivostok. An eminent British Naval expert told me that were it not for the threat of Russian air bombardment launched from Vladivostok against Japan's capital cities, that Japan would have washed out Russia in the Far East long ago.

Vladivostok is only approximately 500 miles away from the heart of Japan, a distance easily within the range of modern bombers.

While the Japanese could just as easily attack our air bases in Alaska as our bombers could get at Japan, they would be bombing our military establishments only, while we would be getting at the heart of the Japanese homeland.

Since air attack is superior to the defense against it, we would be playing air power cards in proper sequence—if we had the air power.

There is only one answer to a threatened air war, and that is to beat the other fellow to the punch—or threaten to do it with more chances of achieving wholesale devastation than he cares to contemplate.

It is true that the Navy is building an air base at Sitka and it has completed surveys for two more, one at Kodiak, and the other further westward, or closer to Japan, in the Aleutian Islands. But again the objective falls short of real air power.

No matter where we turn in any plans for war with Japan in the far Pacific we find ourselves scheming to defend what we have, and with only remote chance of making a single stab at Japan proper with air power alone—not a chance with sea power.

If air war should come to our East coast, the Navy would be even less prepared at that point. The Naval concentration on the Atlantic at present is limited entirely to a base at Norfolk, for Navy planes, and a base at Quantico, Virginia, for Marine Corps planes. Pensacola, of course, is an enormous plant, but that is for training purposes only. There are plans for several air bases in addition to the ones we already have in the Atlantic sector, these stations to be set up with a full com-

plement of patrol and carrier units and with service and overhaul facilities.

All this would be strategic if a foreign power projected an air attack against the United States with ship-based aircraft, brought to within easy striking distance; or by operating from a neighboring territory. In that case, the Navy would be able to lunge at the source of the attack.

At least three European powers already have ships that might be squeezed across the Atlantic with bombing loads. England has a bomber, the Vickers Wellesley, which could make the trip with a good sized bomb load on board. It flew 7,162 miles non-stop, for the world's distance record.

There is no question in my mind that the latest Italian Savoia Marchetti, and the German Heinkel 111 would bear the overload of gas for the flight.

The above facts indicate that America is wide open to a bombing attack!

What chance would an aircraft carrier have of accurately locating itself so that its short range fighters could be in the air when and where the enemy arrived? It's too late to dispatch single seater fighters when you see, or your scientific devices detect, enemy bombers. You must know that they are approaching and give your fighters a chance to reach altitude.

As for the ground defense against such an attack, experts still contend that no anti-aircraft gun today can do business above 10,000 feet. I say this in full knowledge that better than 20,000-foot accuracy is claimed for them. But I have seen figures on the performance of the world's best guns in Spain, and I know that above 10,000 feet they've only nuisance value.

I think air power under a separate air force is vital to the defense of the United States. I hope we won't have to lose a war to learn a lesson!

French Radio-Sonde Balloon Sets Altitude Record

The French National Meteorological Office in Paris claims a world altitude record.

One of its radiometeorographs or radio-sondes —small unmanned upper air sounding balloons equipped with automatic weather-noting instruments and radio to transmit data back to the earth—has ascended to a height of 31,465 meters, or 103,200 feet, it states.

This is more than 500 feet above the previous record, set by a German sounding balloon which, however, was not radio-equipped. Manned balloons have not even approached either altitude.

Continuous broadcasts of temperature, pressure and humidity data were made both during the ascent and the descent. The balloon was released from St. Cyr, near Versailles. Radiosondes are used regularly both in the United States and in other countries for making upper air soundings on which weather forecasting is being increasingly based.

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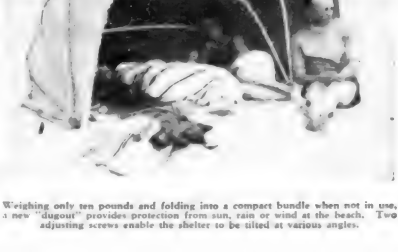

Weighing only ten pounds and folding into a compact bundle when not in use, a new "dugout" provides protection from sun, rain or wind at the beach. Two adjusting screws enable the shelter to be tilted at various angles.

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Self-Closing Top Improves Powder Can

Invented by W. C. Heatlie, of Norwood, Mass., a new type of self-closing top for tooth powder cans is fitted with a specially designed opening which eliminates the need for touching the powder when using. Left photo shows old type can in use and the right photo shows how the new lever-operated top directs powder onto brush.

Moving Electric Fan Blades Aid Study Of Lightning

The old adage that lightning never strikes twice in the same place has been pretty well disproved in recent years by scientific studies showing that anywhere up to a dozen separate flashes comprise a lightning bolt.

If you doubt this, the electric fan in your house provides a good experimental apparatus to demonstrate this multiplicity of flashes in a single lightning stroke. Dr. H. L. Dean of the State University of Iowa's botany department discovered this fact and reported it in the scientific journal, Science.

During an electrical storm Dr. Dean watched the reflection of the lightning flash in the swirling blades of a moving electric fan. He was surprised to see the blades appear to stand still in some cases and in others appear to rotate slowly in the direction of their original rotation.

What happened is that the multiple strokes of the lightning flash came with such quickness that the alternation of light and dark between them (too fast for the human eye to follow) came just in phase with the rotation of the fan blades. This stroboscopic action accounts for the fan's "standing still" despite its rapid rotation.

If you mount your own electric fan before a window you should be able to see the same effect. It is best to do it at night and have the room in darkness to provide a black background, for the lightning reflections.

By the end of this year New York City will have 12,000 traffic signals.

New English Torpedo Boats Attain 50 M.P.H. Speed

England is building a swarm of high speed motor torpedo-boats whose top speed of 50 miles an hour is only one distinctive feature, specifications of one type demonstrated in London reveal.

Seventy feet long and powered with three 1,000 horsepower engines, each mosquito boat has a range of a thousand sea miles at a cruising speed of 20 to 22 knots.

Mounted on the tiny gun platform of each boat are a pair of 21-inch torpedo tubes or four 18-inch tubes, as well as two 20-millimeter anti-aircraft guns and a 25-millimeter gun designed to take care of opposition from not-too-large surface craft.

No funnel or mast or other obstruction breaks the line of the hull. Two officers and six or seven men make up the tiny man-of-war's crew.

Scientists Identify Wood In Pulverized, Sawdust State

Wood analysis, which has played a notable role in crime detection, notably in the Lindbergh kidnaping case, is carried to a new refinement by Drs. J. Kisser and L. W. Sekyra, research botanists of the Vienna Academy of Science.

They have developed methods of microscopic examination by which they have been able, in many instances, to identify wood that had been pulverized or reduced to sawdust, and in some cases even after it had been burned to ashes.

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New Arrangement Lengthens Life Of X-Ray Tubes

A new and simple arrangement of X-ray tubes which may ultimately reduce the cost of X-ray treatment in cancer therapy was reported to the American Physical Society recently by Dr. G. Failla, chief radiologist of the Memorial Cancer Hospital, New York City.

Chief merit of the new system is that it uses existing apparatus and yet eliminates certain parts so that the cost of a superior X-ray therapy installation is cut. Moreover, the life of the expensive X-ray tubes—costing $450 each—is materially increased.

Dr. Failla, well-known American authority who has served on international committees on X-ray dosage standardization, told his fellow scientists that the key point in the new, cheap installation is the use of two X-ray tubes working on alternating current. Part of the past expense of X-ray treatment has been the necessity of using rectifying tubes which turn the alternating current from high-voltage transformers into direct current for use in the tubes.

By the new Failla setup alternating current is employed and each tube works on a "half-wave" of the cycle alternately. One tube is placed below the material, or patient, being radiated and the other tube above so that the intensity is obtained. In tests a radiation intensity of 7,000 roentgens per minute has been obtained, as compared with the 50 roentgen per minute standard output.

"The surprising thing," said Dr. Failla, "is that the tube life with this arrangement is longer than usual. In the case of two such machines used at Memorial Hospital for routine treatment of patients, one of the tubes has been in actual operation for over 3,700 hours, and is still in good condition. This is an important item, considering that each tube costs about $450."

Modern Museum To Feature Air Conditioned Halls

The latest thing in modernistic museums was described before officials of museums throughout the country, gathered for the opening meeting of the American Association of Museums, held recently in Philadelphia, Pa.

Now being constructed for Grand Rapids Public Museum, the ultra-modern museum is a long, low concrete-and-steel building. It has plate glass show windows on the street, to advertise "specials" inside, copying department store psychology.

Inside, corridor walls are glass brick. Partitions move like curtains, so curators can shift scenes. Exhibition halls are lighted artificially, to show historic and scientific treasures in the best lights. Air conditioning protects collections from heat and dampness.

Carriage Fitted With Cradle

Developed in London, England a new baby carriage is equipped with a removable cradle which facilitates the carrying of a sleeping infant upstairs. Lifted from the carriage in the cradle, the infant is not likely to awaken whereas the handling required without the cradle usually serves to arouse the baby.

Instrument "Fingerprints" Ink, Detects Forgeries

Development of an instrument that will "fingerprint" pen strokes, enabling experts to detect new information about rare old manuscripts has been accomplished by Capt. R. B. Haselden, curator of manuscripts at the Huntington Library in San Marino, Calif.

The delicate microchromometer, as it is called, by enabling Capt. Haselden to determine the color of minute penstrokes, reveals whether one or more inks were used in manuscript, and is especially valuable in the study of scripts in which corrections occur. It also assists in the detection of forgeries. It was built at the California Institute of Technology.

Operation of the instrument, on the surface, appears simple enough, but considerable electrical equipment is necessary.

The pen stroke is placed under a high power microscope and suitably illuminated. A photoelectric cell resolves the light waves from the eyepiece of the microscope. The light impinging on the photo cell causes the cell to give off electrons, and an extremely small current is set up. The current is so small it has to be enormously increased by an amplifier. It is then read on a millampere meter, due precautions having been taken to filter out infra-red light.

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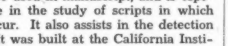

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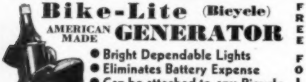
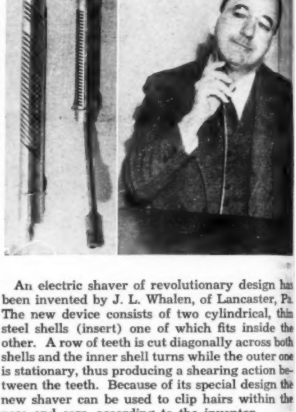


Electric Shaver Features Revolutionary Design



An electric shaver of revolutionary design has been invented by J. L. Whalen, of Lancaster, Pa. The new device consists of two cylindrical, thin steel shells (insert) one of which fits inside the other. A row of teeth is cut diagonally across both shells and the inner shell turns while the outer one is stationary, thus producing a shearing action between the teeth. Because of its special design the new shaver can be used to clip hairs within the nose and ears, according to the inventor.

Aircraft Carburetor Works In Any Flight Position

Development of a carburetor that solves two outstanding aircraft engine problems was reported recently to the Society of Automotive Engineers by M. J. Kittler, chief engineer of the aircraft division of a well-known carburetor company.

The new carburetor, which uses a diaphragm mechanism to control fuel flow instead of the more usual float, assures aircraft engines of a constant flow of fuel regardless of the plane's position, a matter of importance particularly in military aircraft which are called upon to execute maneuvers such as dives and loops.

By keeping metal surfaces in the carburetor out of the way of the expanding stream of fuel, which travels so fast it is out of the carburetor before it has reduced temperature in the carburetor markedly, icing is prevented. Carburetor icing has been a matter of concern to the air industry for many years.

British, American Scientists Plan Closer Cooperation

Plans are being laid by the American and British Associations for the Advancement of Science for the organization of international cooperation among scientists on a wider scale than exists at present.

The secretaries of the two national organizations are exchanging notes on methods of cooperation and a conference, either of British and American representatives alone, or a larger meeting of scientific leaders from all countries interested, is tentatively scheduled for the near future.

Arising from the increasing realization in both nations that scientists are responsible in large measure for the effects of science on society, the present moves for formal cooperation originate from a resolution passed by the council of the American Association for the Advancement of Science at its meeting last December. The stage for this action had been set by the emphasis upon "science and society" provided by the 1936 and 1937 meetings of the British Association.

The British viewpoint is that the proposed world organization essentially would be composed of national and scientific groups that uphold the democratic ideals and mechanisms of scientific freedom. The British scientific journal, "Nature," of which Sir Richard Gregory, Bart, is editor, has led in emphasizing the need of resisting the encroachments that totalitarian governments have made upon scientific methods and liberties of thought.

The invitation to cooperation should not be dependent on racial, political or theological qualifications, Dr. F. R. Moulton, permanent secretary of the American Association, has urged. He contemplates the "formulation of a set of fundamental scientific principles of an ethical nature on which unanimous agreement of the delegates can be reached" and "the formulation of the maximum number of inviolable methods of international intercourse and cooperation among scientists on which the delegates can unanimously agree."

How To Build A Quadru-Table

[*Continued from page* 88]

on each edge. Prepare twelve 2-in. dowels that fit snugly in these holes, yet are readily removable. These pins prevent all "wobble" when two or more tables are used together.

MATERIAL LIST

1 board, 10-in.x ¾-in.x9-ft.
1 board, 2-in.x ⅞-in.x16-ft.
1 board, ¾-in.x ¾-in.x8-ft.
12 flat brass hooks, 1½-in. long, with screws to match.
4 doz. No. 6 ¾-in. screws.
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—*W. Keith Vining*

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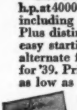

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Enclosed in a washable cover which is tied in position on the head with a tape, a new compact variable-heat electric pad provides warmth to relieve congestive pain. A small sponge, fitted in a porous pocket in the cover, provides moist heat in cases requiring such treatment.

An accurate 10-inch slide rule which enables the user to do difficult calculations instantly without the need of pencil and paper. Fitted with a magnifying indicator.

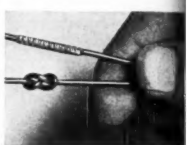
A new booklet on woodworking tells what projects to make, how to make them and how to sell them when completed. Price is 10c.

Only a few minutes are required to dry photographic prints in this electric dryer. Thermostatically controlled, the device will not scorch the prints. Drying area is 11x15 inches.

A compact machine which quickly and efficiently cleans automobile upholstery, chairs and other fabric-covered objects.

An electrically-operated machine which can be used to sharpen lawn mowers, skates, grass shears, scythes, axes, etc. Can be installed in any small garage or workshop.

An automatic filter device which fits onto any ordinary water faucet.



Eliminating the need for space-consuming protective coatings, newly developed magnet wire features a thin coating of synthetic resin which can be knotted or crushed with a pliers without injury, as demonstrated above.

A rubber mold-making outfit for making perfect flexible molds for casting ash trays, bookends, plaques, etc., from plaster.

A trouble-shooting chart which facilitates finding of troubles in electric motors and tells how to repair them.

An automobile engine carburetor device which is said to greatly increase mileage.

A small electric lamp that can be fitted to the head by means of a special brace. Throws light on workbench or table, leaving the hands free to handle tools. Operates on A. C. or D. C. current.

A hand pump for garage or home which pumps oil, paints, etc., from drums.

A built-in scale in the handle of a new fish net enables the angler to determine the weight of his catch. A hooked clutch (insert) locks the scale to the handle when not in use.